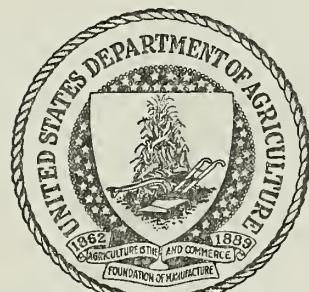


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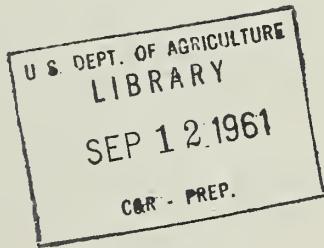


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A DETAILED ANALYSIS OF RESEARCH
IN THE U. S. DEPARTMENT OF AGRICULTURE,
as related to the report
AN EVALUATION OF AGRICULTURAL RESEARCH
3a
for Use of Department Scientists
and Their Cooperators



115 56
Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

P R E F A C E

This report presents a detailed analysis of the research program of the U. S. Department of Agriculture, made in the light of the conclusions reached in a report entitled, "An Evaluation of Agricultural Research," 1/ developed jointly by the Department, the State Agricultural Experiment Stations, and the Forestry Colleges. The present report was prepared for use by Department scientists and their cooperators by the Department's Committee on Research Evaluation with the collaboration of research division directors and 20 task groups selected from the Department's staff. The members of the Committee and its task groups are listed at the end of the report.

The report consists of 20 summaries beginning on page 14--one for each of the 16 objectives for agriculture enumerated in the report cited, and one for each of 4 selected commodity fields that were appraised independently.

In the columns of the summaries headed "Present Program," synopses are provided of the research currently being conducted in the U. S. Department of Agriculture that contribute to the attainment of the several objectives or to the solution of problems related to the commodities appraised. In the columns headed "Recommended Changes in Program," are indicated the changes required to achieve an adequate, balanced, Department research program in these areas. The organizational units of the Department involved in the research described in each instance are indicated by appropriate symbols identified on page 13.

Study of the summaries will reveal that very specific lines of work are often indicated under "Recommended Changes in Program." It was considered necessary to do this to make the recommendations meaningful and to provide positive guides for program changes in the years ahead. Obviously, all of the specific problems that will need attention in the coming decade could not be forecast by the Committee and doubtless many besides those given will need to be added to the list during that period to meet unforeseen needs. In the aggregate, however, the specific lines indicated point the general direction in which the program for each subdivision of each objective or commodity field should go as the Committee now views and is able to project the need.

Preceding the summaries is an index, listing by short title each objective and commodity field, with appropriate sub-objectives or sub-headings.

1/ Available on request from the Office of Information, USDA, Washington 25, D. C.

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SYMBOLS USED IN THE SUMMARIES (SEE PAGES 14-49), INCLUSIVE,) TO IDENTIFY USDA ORGANIZATIONAL UNITS

ACPS	- Agricultural Conservation Program Service	FMR	- Forest Management Research Division, FS
ADP	- Animal Disease and Parasite Research Division, ARS	FMRQ	- Food Materials Requirements Division, CSS
AE	- Agricultural Engineering Research Division, ARS	FPR	- Forest Products Research Division, FS
AEC	- Agricultural Economics Division, AMS	FRTP	- Foreign Research and Technical Programs Division, ARS
AES	- Agricultural Estimates Division, AMS	FS	- Forest Service
AH	- Animal Husbandry Research Division, ARS	HHE	- Household Economics Research Division, ARS
AMS	- Agricultural Marketing Service	HN	- Human Nutrition Research Division, ARS
ARS	- Agricultural Research Service	MD	- Market Development Research Division, AMS
CCC	- Commodity Credit Corporation	ME	- Marketing Economics Research Division, AMS
CEA	- Commodity Exchange Authority	MQ	- Market Quality Research Division, AMS
COT	- Cotton Division, AMS	MS	- Management Services Division, FCS
CR	- Crops Research Division, ARS	NU	- Northern Utilization Research and Development Division, ARS
CSS	- Commodity Stabilization Service	OA	- Office of Administrator
ENT	- Entomology Research Division, ARS	RMR	- Range Management Research Division, FS
EU	- Eastern Utilization Research and Development Division, ARS	R	- Research, FS
FAA	- Foreign Agricultural Analysis Division, FAS	SCS	- Soil Conservation Service
FAS	- Foreign Agricultural Service	SS	- Special Services Division, AMS
FCA	- Farm Credit Administration	SU	- Southern Utilization Research and Development Division, ARS
FCS	- Farmer Cooperative Service	SWC	- Soil and Water Conservation Research Division, ARS
FD	- Food Distribution Division, AMS	TF	- Transportation and Facilities Research Division, AMS
FDR	- Forest Disease Research Division, FS	TP	- Trade Policy Division, FAS
FE	- Farm Economics Research Division, ARS	WMR	- Watershed Management Research Division, FS
FER	- Forest Economics Research Division, FS	WU	- Western Utilization Research and Development Division, ARS
FES	- Federal Extension Service		
FFR	- Forest Fire Research Division, FS		
FIR	- Forest Insect Research Division, FS		
FM	- Foreign Market Information Division, FAS		

OBJECTIVE 1-L-To increase knowledge regarding the needs, wants, and preferences of people for agricultural and competitive products, and to apply this knowledge in educational and other programs relating to production, processing, marketing, and consumption.

Definition or description of the nature and dimensions of people's needs, wants, and preferences for products for reasons of health, safety, comfort, convenience, or other satisfactions is needed (a) to understand and forecast demand; and (b) to help educational and other programs designed to modify and improve consumption.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
<p>1.1 PHYSIOLOGICALLY DETERMINED NEEDS</p> <p>1.1.1 <u>Food and nutrients.</u> (a) Functions, interrelations, and quantitative needs for nutrients, including "essential" fatty acids, magnesium, pantothenic acid, basal metabolism, and energy expenditures (children and women); effect of dietary carbohydrates on amino acid and fatty acid requirements; and compilation of nutrition reference data; (b) State of human nutrition supported by customary diets; metabolic response of individuals to standardized reference diet, and of children to controlled "normal" diets; and human utilization of nitrogen, selected amino acids, and food energy from selected foods; (c) Biological response to various food combinations, including effect of diet on rate of physical impairment (rats); (d) Translation of nutrient requirements into guides for food selection and food budgets at various cost levels within accepted food habits. (HN, HHE)</p> <p>1.1.2 <u>Textile products; detergents; plastics; tobacco; wood and wood-derived products.</u> Some study on design and construction of garments to facilitate safety, efficiency, and comfort among women wearers whose freedom of body movement is limited. (CH)</p>	<p>1.1.1 (a) Expand and accelerate research on requirements for nutrients by each of some 20 age-activity groups of men, women, and children, and factors affecting requirements; studies of interrelations among amino acids, fatty acids, carbohydrates, minerals, and vitamins; (b) and (c) Expand studies of normal variability in metabolic response of different population groups to specific types of diet, and of factors affecting response; (d) Accelerate work, taking into account new research results, on food selection guides and food budgets for use in changing market situations, in rural development programs, and in national emergency. (See also Objectives 8 and 12) (HN, HHE)</p> <p>1.1.2 (a) Expand program to include studies of design of apparel and of fabric composition and construction for normal or handicapped persons in relation to factors affecting comfort and efficiency, such as freedom of movement and conservation or dissipation of body heat; (b) Undertake foot measurements basic to shoe sizing; (c) Initiate studies of various attributes of nonfood agricultural products in relation to health or comfort of the user, including clothing, surfaces for housing interiors and exteriors, household textiles and furnishings, paper products, and detergents. (CH, FPR)</p>
<p>1.2 SOCIALLY CONDITIONED WANTS</p> <p>1.2.1 <u>Consumer practices in purchase and use of goods.</u> (a) Surveys of household consumption, by income, region, and urbanization, including quantities and forms used, expenditures for, source, home processing, with analyses of relative importance of factors influencing consumption patterns; estimates of nutritive value of food consumed, diet appraisal, and study of interrelationships in consumption among groups of foods; (b) National consumer panel reporting monthly on purchases of selected food items; (c) Occasional studies of household practices in the handling, care, and preparation of foods; (d) Occasional studies of inventory and purchase data of nonfood items to determine replacement rates of durable goods and to provide details on nature and composition of products used in family living. (HHE, MD, AEC)</p> <p>1.2.2 <u>Consumer attitudes toward, acceptance of, preference for goods.</u> (a) Surveys of consumer preferences for foods and food forms, including preference ratings for quality factors, patterns of substitution and acceptance of new products; (b) Studies of effect of merchandising practices or appeals on consumer purchases; (c) Preferences for and use of selected items of apparel and household textiles made of natural or competing fibers or plastics--one or two national surveys each year; (d) Some effort to appraise consumer preferences for wood products. (MD, FER)</p> <p>1.2.3 <u>Estimates of annual per capita disappearance of goods into civilian consumption.</u> Estimates are made for specific years and over time for foods; for cotton, wool, and competing fibers; for five major tobacco products and for tobacco by major types. From the food data are estimated the nutritive content of diets, and the nutritional contributions of broad food groups. (AEC, HHE)</p>	<p>1.2.1 (a) Undertake periodic large-scale surveys of household consumption at 10-year intervals, with intervening smaller cross-sectional studies and consumer panel reports; (b) Initiate continuing consumer panels giving information weekly on purchases, to provide data on seasonality and on effect of promotional or merchandising programs; (c) Initiate studies of food consumption of individuals (classified by age and activity) in homes and in institutions and public eating places; accelerate investigations of household practices in procuring and using food, including discards of food; (d) Initiate studies of effectiveness of various types of educational and promotional programs in modifying food habits. (HHE, MD, AEC)</p> <p>1.2.2 (a) - (c) Expand coverage and frequency of studies of consumer preferences for various products or groups of products; increase emphasis on underlying factors, and undertake cross-survey analyses in an attempt to develop principles of consumer behavior; (d) Expand with emphasis on house construction, non-residential construction, and manufactured products. (MD, FER, FPR)</p> <p>1.2.3 (a) Strengthen estimates of food production and stocks, and of information on the forms in which food is marketed; (b) Expand work to measure domestic distribution and utilization of fiber products, developing conversion factors to express quantities of products at various stages of processing and distribution in terms of fiber equivalents; (c) Improve data to trace changes in tobacco consumption within broad categories; (d) Strengthen estimates of annual consumption of wood products. (AEC, FER)</p>
(See page 13 for key to agency symbols)	

OBJECTIVE 2.--To discover, identify, and measure the inherent nutritive and other values of farm and forest products that make them useful in satisfying human needs and wants directly as food, textiles, or other products and indirectly through industrial processing; to develop handbooks, tables of values, and other guides for selecting and using these products effectively.

The values to be identified, classified, measured, described, and cataloged include all the attributes, characteristics, constituents, and properties of farm and forest products--those esteemed directly such as nutritive values, flavor, texture, strength, thermal properties, and durability, and those useful for modification, such as chemical and physical properties. More and more this research is probing into the nature, usefulness, and behavior of the elemental constituents of farm and forest products and into ways of manipulating them to preserve original values or create new ones. Research toward this objective draws its importance largely from its relation to that of Objectives 1, 8, 9, 10, 11, and 12.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
2.1 FOOD AND FEED	
2.1.1 Nutritive values. Data on the composition and nutritive values of food and feed are needed in great detail for all types of products--raw and processed--for estimates of the actual and potential contribution of the product to nutrition, and for appraisal of factors affecting nutritive value. Practical methods of analysis are a major problem.	<p>(a) Collation of data on composition and nutritive value of all kinds of food from scientific literature and from unpublished sources. (b) Systematic analyses, including development and improvement of methods as needed, to fill gaps in tables of food composition--proximate composition and qualities of (1) nitrogen and amino acids; (2) total fats and nutritionally important fatty acids; (3) various forms of carbohydrates and related substances; (4) mineral elements; and (5) vitamins. Emphasis is placed on those foods for which present data are obsolete or fragmentary and those substances the nutritional significance of which has been only recently recognized. (c) Discovery or identification of new nutrients in food and feed. (d) Determination of relation of nutrient content of various commodities to variety, breed, cultural practices, processing (industrial and household), storage and marketing conditions. (e) Analyses of forage plants, range plants, feed grains, feed concentrates (oilseed meals, forage, meat-scrap and tankage) and poultry feathers for the quantity and availability of selected minerals, vitamins, and new growth factors, nitrogenous compounds, carbohydrates and their derivatives; isolation and characterization of biologically active components such as tannins, saponins, and flavonoids in forages and grasses, or gossypol in oilseed meals. (f) Compilation of data on the composition of dry, green, and ensiled forages. (g) Relation of soil to nutritive value of forages.</p> <p>(HN, HHE, AH, CR, SWC, EU, NU, SU, WU, MQ, RMR)</p>
2.1.2 Acceptability and related values. The elements that make products attractive to consumers often exert more influence on acceptance than do more vital properties. Information is needed, therefore, on attributes governing acceptability as a basis for efforts to enhance the market value of products.	<p>(a) Determination of properties of food that affect consumer use, and development of principles and procedures for improved household utilization of foods, with reference to properties, such as those affecting cooking and eating quality, yield of edible material, functional properties, and palatability (flavor, color, texture). (b) Studies to develop, adapt, and improve physical, histological, bacteriological, sensory, psychometric, and cooking methods for evaluating properties and qualities of concern to consumers. (c) Studies of acceptability to animals of feeds and range forage.</p> <p>(HN, EU, WU, MD, MQ, RMR, CR, AH)</p>
2.1.3 Stability and market life. Market demands for year-round availability of fresh fruits and vegetables and other perishables, and the shipping time and distances required to meet demands, make the qualities of stability and long market life highly desirable. It becomes increasingly necessary to know what constituents deteriorate and how the changes occur so that ways can be found to maintain quality. There are analogous problems in quality maintenance during storage of other farm products such as grain.	<p>(a) Research including studies on the physiology and pathology of living tissues, and on the microbiological, acidic, and other deteriorative changes in non-living materials, in order to devise means of preventing loss of nutrients, wholesomeness, or grade during marketing or storage.</p> <p>(HN, EU, NU, WU, MD, MQ)</p>
2.1.4 Toxicities, growth inhibitors, and allergens. (a) Studies of the nature of and possibilities of inactivation of certain allergens in edible and industrial proteins. (b) Search for the principles in forages causing, and conditions under which they cause, bloat in ruminants, and methods for control or avoidance. (c) Studies to isolate and identify unknown factors in alfalfa and cottonseed that inhibit growth of young animals. (d) Studies to determine the occurrence and identity of an antimetabolite of Vitamin B ₁ , a toxic protein from untoasted hexane-extracted soybean meal, and a toxic principle in tung meal. (e) Studies on plants toxic to different farm animals.	<p>(AH, ADP, SU, NU, EU)</p>
	<p>(a)-(c) Expand with emphasis on inactivation when active agents are identified. (d) Curtail work on the toxic principle in tung meal pending economic study of importance of tung meal as a feed. Initiate research on the toxic principle in castor pomace and on minor constituents of cottonseed. (e) Expand and initiate work on relation of mineral nutrition to toxicity of substances in plants.</p>

(See page 13 for key to agency symbols)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

2.1 FOOD AND FEED--Continued

2.1.5 Processing properties. Knowledge about properties affecting processing of crop, livestock, and forest products is rapidly gaining importance because of the search for new industrial outlets, increasing mechanization in utilization, and the increasing shifting of food preparation from kitchens to factory.

(a) Determination of properties of raw and processed fruits and vegetables such as nutrients, flavor, and color, and changes resulting from processing and storage. (b) Study of basic constituents of poultry, dairy, and animal products responsible for such properties as toughness, flavor, keeping quality, heat transfer, and decomposition of fats. (c) Studies of constituents of oilseeds and peanuts such as protein components, color bodies, bitter constituents, and phosphatides. (d) Studies of baking potential of wheat, kernel structure, and milling qualities of wheat and corn, constituents of grains, and improved analytical methods. (e) Studies of constituents of beet and cane sap affecting sugar, recovery, and those responsible for flavor in honey and maple products. (f) Determination of protein and other nutritive values, toxic constituents, and related properties of processed concentrates used for feed.

(EU, NU, WU, SU, CR, APF, AH, HN, MQ, FPR)

2.2 FIBERS (EXCEPT WOOD); FABRICS AND TEXTILE ARTICLES. Rapid technological development in man-made fibers has focused attention on fiber properties and their adaptability for various uses. There is urgent need, therefore, to determine the properties of natural fibers, their performance in use, how they can be improved, how they can be blended with man-made fibers to give better fabrics, and how household care and use of fabrics are affected by their composition and construction.

2.2.1 Fibers. Research on cotton properties is directed toward their relation to processing, functional properties of cotton products, and durability. Studies may be grouped under:

(a) Physical properties such as fiber lengths, strength, and crimp as related to spinning, weaving, and textile properties. (b) Response of fiber properties to fiber modification by chemical treatment and irradiation. (c) Microscopic and sub-microscopic structure of fibers. (d) Deterioration processes, as by weathering, and methods for measuring extent of deterioration. Research on wool fibers is concerned with: (e) Correlation of mechanical properties of natural and treated wool and mohair fibers with their physical and chemical structure and mineral content. (f) Causes of fleece yellowing. (g) Genetic relations of fiber properties.

(SU, WU, CR, APF, MQ)

2.2.2 Fabrics and textile articles. (a) Studies on cotton fabrics relate physical properties, durability, launderability, dimensional stability, and serviceability in use to fabric type and geometry and to special treatment given fibers or fabrics. (b) Comparable studies to those in (a) are made of wool fabrics differing in construction and made from different grades of wool. (c) Studies of blends and fabrics of man-made fibers to learn advantages and disadvantages of each.

(WU, CH, SU)

2.3 FOREST PRODUCTS. Data and information on the properties and composition of more than 1,000 species of native and foreign forest trees are needed to increase the usefulness of timber resources in meeting human needs through safe use of wood in construction, through new and better products, by devising ways of using defective material and little-used species, and by protecting wood against deterioration in use.

2.3.1 Wood. Studies can be grouped under: (a) Basic structural and anatomical characteristics of wood as affected by hereditary factors, site and growing conditions, and as related to density, strength, warping, machining properties, and resistance to insects and rots. (b) Evaluation of physical and chemical characteristics of wood fibers and their relation to properties of pulp, paper, and allied products. (c) Development of improved processes for separation of extractives, cellulosic, and lignin components of wood and determination of their composition and chemistry. (d) Determination of the chemical composition of bark and chemistry of its constituents. (e) Determination of chemical, structural, mechanical, thermal, and electrical and radiological properties of wood and wood-base materials and the effects of moisture, temperature, and compression in modifying these properties. (f) The mechanisms of adhesion, penetration, and diffusion of adhesives, protective coatings, and preservatives used with wood and wood-base materials. Studies are also conducted on the composition and properties of adhesives, protective coatings, and preservative chemicals as they relate to use with wood.

(FPR, FDR, FIR, FMR)

2.3.2 Gum naval stores. Studies on: (a) Composition and properties of the constituents of pine gum and rosin; (b) Relationship between processing conditions and the composition, properties, and quality of the extracted turpentine and rosin.

(SU)

(a) Expand research on fruits and vegetables with emphasis on composition and factors responsible for change, as mechanism of enzyme systems, and post-harvest physiology. (b) Expand work on meat constituents, and on tenderization of muscles; on basic composition of egg lipoproteins; on processing changes in dairy products. (c) on oilseeds and processing changes in cottonseed oil; and on changes in peanuts affecting processing. (d) Expand work on compositional studies of grains, improvement of baking properties of wheat flour, improved moisture tests and improved methods for measuring protein content of wheat. (e) Expand studies on sugar recovery from cane and beets, and sirups from cane and sorgo. (f) Expand research on improved analytical methods for oilseed proteins, and begin work on insoluble carbohydrates in oilseed meals. (See also Objective 11)

(EU, NU, WU, SU, CR, APF, AH, HN, MQ, FPR)

Cotton. (a)-(c) Expand and accelerate generally with some increased emphasis on improved instruments and methods of measurement and study. (d) Expand with emphasis on yellowing and mildew. Initiate research on properties and fine structure of other vegetable fibers, and on basic chemistry of their cellulose. Wool. (e) Expand with emphasis on finding simpler methods for measuring wool properties related to processing, on advanced analytical techniques for study of physical and chemical properties, and on appearance factors, such as wrinkling and crease-resistance. (f) Expand with close integration with development of advanced techniques in (e). (g) Expand with emphasis on use of simple methods developed in (e).

(SU, WU, CR, APF, MQ)

(a), (b) Expand fabric evaluations to many other knit and woven fabrics, including in evaluations comfort and allergenic properties, ease of control of deteriorative agents, thermal and moisture properties, and performance-in-use for clothing and other textile end-uses. (c) Expand with reference to blends of cotton and wool with other fibers to provide properties for specific end uses.

(WU, SU, CH)

(e) Expand work on fundamental physical structure of wood and wood fibers; relate structure and chemical composition of wood to physical properties of 1,000 commercially important tree species. (b) Expand studies of chemical and physical properties of wood pulp fibers. (c) Expand work on the chemical nature and composition of lignin; determine constituents of wood responsible for decay resistance. (d) Expand. (e) Expand, with emphasis on strength values for plywood, hollow-core and "sandwich" construction; strength classification standards for structural wood; physical properties of fiberboards and particle boards. (f) Expand studies of movement of moisture through wood, fundamentals of adhesion, and components of wood preservatives toxic to fungi and insects. Initiate work on constituents of wastes from pulp mills and similar wood-processing and conversion plants to find uses for them and eliminate air and water pollution.

(FPR, FDR, FIR, FMR)

(a), (b) Continue with emphasis on properties useful for new products pending results of economic study of the future of the naval stores industry.

(SU, MQ)

OBJECTIVE 2--Continued

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

2.4 MISCELLANEOUS PRODUCTS. Grouped here are studies on the properties of agricultural products not included above. Some of the products constitute a minor part of agricultural production; on others, research is limited. Collectively, however, these products and commodities have an important place in the economy and research on them is necessary.

2.4.1 Tobacco. Studies on chemical components of tobacco and tobacco smoke, and on relation of breeding and growing conditions to alkaloid formation in plants.

Expand to include effects of curing and fermentation.

2.4.2 Leather. Studies on the correlation between properties of isolated collagen fibers and 2-dimensional properties of the leather, and on the chemical and physical structure of collagen and its interaction with other hide components in tanning.

Expand to include tests for deterioration of hide and leather quality, and tests of entirely new tanning methods.

2.4.3 Nonfood fats and oils. Studies on the glyceride and fatty acid composition of fats and oils in relation to their use in protective coatings, and on the effects of environment on industrial potentials of oils from oilseeds.

Expand with emphasis on chemical composition of fats and oils to reinforce processing research designed to increase industrial uses.

2.4.4 Cereal grains for industrial use. Studies on chemical composition and physical structure to provide basis for selection and development of grains and their constituents as industrial raw materials.

Expand with emphasis on chemical constituents of grain, physical-chemical properties of cereal starches, and composition and structure of grain kernels.

2.4.5 Special crops. Screening and development of plant materials for potential new crops and research on specific adaptabilities of plants such as resistance to disease, insects, heat, cold, drought, excess moisture, or salt concentrations. Research on new methods of analyzing spices.

Expand screening and developmental studies on potential new crops; develop new and improved methods for quality evaluation of spices.

2.4.6 Ornamentals. Research on identity, nature, reactions, and measurements of the pigments in certain flowers and their change in response to nutrient conditions.

Expand work on means of objectively determining color, odor, flower, or leaf surface texture, and related qualities.

2.4.7 Seeds. Development of new physiological information for determining the plant-producing potentials of seeds.

Expand work on the enzyme systems that govern seed germination, the pigments that control light sensitivity, and the factors responsible for certain types of dormancy.

(SU, EU, NU, WU, CR, FMR, FIR, FDR, RMR, ENT, MQ)

(SU, EU, NU, WU, CR, FMR, FIR, FDR, RMR, ENT, MQ)

(See page 13 for key to agency symbols)

OBJECTIVE 3.--To appraise periodically the prospective demands for the many farm and forest products and the current and potential capacity for production, processing, and distribution of these products to meet short and longer term market demands and to determine the balance between supplies and market demands, for each commodity and in total for farm and forest products; to determine the adjustments in production, processing, and distribution (including the development of domestic and foreign outlets) that are necessary to achieve a desirable balance between supplies and market demands in the years immediately ahead and over the longer term.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
3.1 OUTLOOK AND SITUATION ANALYSIS (SHORT TERM)	
<p>3.1.1 <u>Farm products.</u> Short-term analysis of production, demand, and consumption, domestic and foreign, including overall analysis of agricultural-industrial relationships, commodity analysis, outlook for farm costs (production and living), indebtedness, land values, insurance, and taxes; improvement in research methods. (AEC, FI, FE, HHE, FAS, CSS, FES)</p> <p>3.1.2 <u>Forest products.</u> Analysis of production and demand for the year or two ahead, overall and by commodities. (FER)</p>	<p>3.1.1 Expand research throughout, including regionalization of outlook work, overall and commodity analysis (production, demand, and consumption), agricultural-industrial relationships, foreign supply and demand, agricultural and trade policies of foreign governments, foreign economic development programs, and improvement in tools of analysis. Emphasis should be given to factors affecting supply of farm products. (AEC, FI, FE, HHE, FAS, CSS, FES)</p> <p>3.1.2 Continue, since this research is a part of the more important area of longer term prospective demand and production. (FER)</p>
3.2 LONGER TERM DEMAND PROSPECTS	
<p>3.2.1 <u>Farm products.</u> Research on general economic growth, on expansion in domestic demand for farm products, including projection of trends in consumption and factors affecting these trends; on price relationships and farm income; and on foreign supply and demand. (FI, AEC, HHE, FE, FER, FAS)</p> <p>3.2.2 <u>Forest products.</u> Research on general economic growth; on expansion in domestic demand for forest products, including projection of trends in consumption and factors affecting these trends by principal end uses and price relationships; and on international trade in timber products. Periodic re-appraisal of prospective demand made about every 7-10 years. (FER, FI, AEC, HHE, FE)</p>	<p>3.2.1 Expand to give more emphasis to methodology and improvement of basic statistics and techniques. More research needed on consumer demand and needs and wants, and in area of agricultural-industrial relationships. (See Objective 1.) Provide more adequate foreign statistics and projection of foreign supply and demand. Stress periodic reappraisal of longer term demand prospects and the position of agriculture in a growing economy. (FI, AEC, HHE, FE, FER, FAS)</p> <p>3.2.2 Expand research on consumption for various uses of forest products, including projection of trends and factors influencing these trends; give greater emphasis to work on elasticity of demand and on forestry-industrial relationships. Expand work on forest products consumption on farms and in non-farm construction and on wood used in manufacture of secondary wood products, for pulp and other derived products. Give more emphasis to methodology and improvement of basic statistics and techniques. Continue periodic reappraisal of longer term demand prospects and give more emphasis to work on position of forestry in a growing economy.</p>
3.3 LONGER TERM PRODUCTION PROSPECTS AND NEEDED ADJUSTMENTS	
<p>3.3.1 <u>Farm products.</u> Present program is a pioneering venture, recently initiated, and includes projections of cropland and pastureland, potential crop yields, potential production per animal and animal production per unit of feed, and adjustments in production needed to meet prospective demands. (FE, CR, AH, SWC, FI, AEC)</p> <p>3.3.2 <u>Forest products.</u> Through the Forest Survey, up-to-date forest statistics (by major species and locations) on timber volume and quality, timber growth, area of forest land, and productivity of forest land, are sought. These statistics, plus industrial and other data on forest stands and data from forest production, marketing, and utilization research are analyzed and interpreted in terms of longer term production prospects, the relationship of projected production to projected demand, and adjustments in production needed to meet prospective demands. (FER, FMR, FPR, FIR, FDR, FFR, WMR)</p>	<p>3.3.1 Expand, with emphasis on (a) physical and economic research to obtain more objective estimates of economic potential yield of crops and animals; (b) analysis of factors determining rate of adoption of new techniques by farmers; and (c) more research directed at cost-reduction opportunities. There is urgent need to fill gaps in basic statistics on pasture, range, feed, and encourage needed related research in natural sciences. (FE, CR, AH, SWC, FI, AEC, FMR, FER)</p> <p>3.3.2 Expand Forest Survey to provide more adequate coverage and up-to-date statistics on changes to provide for more detailed information on timber growth, quality of timber, and losses. More research needed on forest-land ownership, rate of adoption of improved forestry practices, costs of production, income, prices, and cost-reduction opportunities. Need to encourage related research in forest and watershed management, forest protection, wildlife habitat, forest recreation, and forest products utilization bearing on problems of prospective production involving needed expansion or adjustments. (FER, FMR, WMR, FPR, FIR, FDR, FFR, FE)</p>
3.4 PROCESSING AND DISTRIBUTION CAPACITY	
<p>3.4.1 <u>Farm products.</u> Studies of major developments in processing, transportation, and distribution as they affect demand for marketing services, including analysis of needed adjustment. Outlook and situation analysis for short term included in studies concerning marketing and transportation. Collection and analysis of quantitative data on physical capacity to process, transport, and distribute farm products. (ME, TF, FCS)</p> <p>3.4.2 <u>Forest products.</u> Studies of capacity to process, transport, and distribute timber products. In times of emergencies, such as during Second World War and Korean Conflict, the research and survey activity in this problem area has been substantial as requested by defense agencies and as partially supported by transferred funds; currently it is minor part of program, limited to keeping abreast of major changes and needs. (FER)</p>	<p>3.4.1 Expand all segments of problem area. Principal needs: More basic data to analyze capacity to process, transport, and distribute farm products; studies of probable effects of new technology and organizational changes on future needs; improvement of short and intermediate term outlook in these fields. Encourage needed related research in natural sciences. (ME, TF, FCS)</p> <p>3.4.2 Continue present program until and unless emergency or defense needs require expansion. (FER)</p>

OBJECTIVE 4.--To identify the obstacles to achievement of balance between supplies and market demands for different products, and to provide technical and economic guides in overcoming these obstacles, including analysis of credit and other program assistance needed to accomplish adjustments that are profitable to producers and in the public interest.

The major purpose of research under this Objective is to discover ways of removing or overcoming the obstacles which are encountered by farmers in attempting to adjust production to achieve better balance with prospective markets. Very little research is now underway that deals directly with obstacles encountered in shifting production of farm and forest products. Although most research on obstacles should be closely integrated with research serving other Objectives, the means of overcoming impediments to achievement of profitable balance between production and markets must have greater emphasis in a well-rounded research program. (See Objective 9.)

	PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
4.1	<u>Production responses to changes in technology, prices, costs, government programs, and other factors.</u> Studies designed to analyze responses by types of farms in several producing areas, and with aggregate responses to price and related factors. (FE, AEC)	Expand to cover major types of production in different regions, and to prepare national summaries of results. Response studies needed to explain maintenance of high output despite lower prices. (FE, ME)
4.2	<u>Availability of alternative farm and forest enterprises or nonfarm employment.</u> Adjustment projects in several farming areas involve farming alternatives. Studies of nonfarm employment opportunities initiated in 1957. (FE, FP, FER, ME)	Expand adjustment studies to appraise production alternatives; should cover about 100 farming areas on a continuing basis, and summarize periodically to compare with market potentialities. (See also Objective 13.) Expand research on forest enterprises and on nonfarm employment opportunities. Emphasize ways of facilitating adjustments on smaller farms. (FE, FP, FER, ME)
4.3	<u>Difficulties encountered in shifting to alternative enterprises.</u> Research on technical aspects of pasture, forage, and feed grains as alternatives to wheat and cotton, and on technical aspects of livestock production; on fruits and vegetables; on new replacement crops; on profitable combinations of crops and livestock; on management of forest lands with some attention to special problems of owners of small tracts. (AH, ADP, CR, FE, FER, FMR)	Initiate research on specific problems encountered by farmers in deciding on adjustments. Expand research on forage, pasture, and feed grain production and on livestock to facilitate shifts to grassland-livestock farming. Expand basic research on nutrition and physiology of forage plants, and on insects and disease control and breeding of quality fruits and vegetables. Expand research on timber yields of managed forests. Initiate technical and economic research to analyze forestry possibilities in farming enterprises and forage production possibilities on present forest lands. Expand research on most profitable combinations of crops and livestock with emphasis on ways of maintaining livestock enterprises under highly variable weather and feed conditions. Emphasize replacement crops for wheat and cotton areas. (AH, ADP, CR, FE, FER, FMR, RMR)
4.4	<u>Requirements and availability of capital for shifting production.</u> Some consideration of capital requirements in adjustment studies. Study of forest credit underway. (FE, FER)	Initiate studies of inadequacies of capital required and of how capital can be provided to promote needed adjustments and repayments geared to flow of income. Expand forest credit studies to determine capital needed for timber growing on land unsuited for crops. Explore need for combining forest credit with insurance against loss by fire and other hazards. (FE, FER)
4.5	<u>Farm size, ownership, and tenancy.</u> Studies on measurement of changes in size and in ownership and tenancy; of leasing arrangements and of ways of improving income on different sizes of owner and tenant farms; of sizes of forest tracts and types of ownership. (FE, FER)	Initiate research to determine changes needed in farm sizes and in tenure relations to shift from wheat to grass and livestock in the Great Plains, and from cotton to grass and timber in the South; to determine how farm size and tenure obstacles can be overcome. Expand research on obstacles to efficient timber production on small tracts. Give special attention to farm woodlots. (FE, FER)
4.6	<u>Institutional rigidities.</u> Studies of population mobility, assessment and taxation of timberlands, rural zoning, and other land-use regulations. Marketing studies of trade and transportation barriers also relate to this problem. (See Objective 14.) (FP, FER, FE, ME, TF)	Initiate research to determine how changes in taxation, zoning, and other institutional arrangements can be used to facilitate desirable adjustments; for example, lower taxes on land shifted from wheat to grass. Expand research on mobility of rural population. Expand research on forest taxation. Expand research on trade and transportation barriers. (FE, FP, FER, ME, TF)

(See page 13 for key to agency symbols)

OBJECTIVE 5.--To undertake the research needed for improvement of buildings, facilities, and equipment used in production, processing, and marketing and to insure their availability for efficient use.

The principal purpose of research and development in this area is to increase efficiency and lower costs at any and every stage of production, processing, marketing, and utilization of farm and forest products. The improvements are derived by engineering and economic application or embodiment of results of biological, chemical, and physical research. They are essential to the maintenance and betterment of the position of farmers and forest owners in the economy.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

5.1 PRODUCTION

5.1.1 Farm. (a) Design of animal structures to provide economically the best environment for all types of animals and poultry, balancing animal needs and work efficiency. (b) Design of structures for drying and farm storage of products such as corn, small grains, fruits, vegetables, and feeds to improve conditioning, preserve nutrient quality, and reduce losses and costs. (c) Development of design criteria and data for wood construction, new structural designs, and methods of treating and using wood for farm buildings to reduce losses from fire, insects, rot, and weather. (d) Improvement of equipment and containers for handling and conditioning products, such as dryers, coolers, and heaters to reduce labor costs and maintain quality; emphasis is on grains, seeds, forage, and silage; limited work on fruits and poultry. (e) Engineering research on tillage machinery; fertilizer equipment and placement; equipment for applying pesticides, herbicides, and defoliators; on cotton mechanization; and on special equipment for crops such as potatoes, grass seed, sugar cane, designed to reduce cuts, bruises, and foreign matter in products, or for crops that present difficult harvesting problems such as castor beans. (f) Basic research on principles of tillage and performance of traction and field transport equipment, especially as related to soil effects. (g) Development of equipment for producing and harvesting long vegetable fibers such as kenaf, sansevieria, and ramie. (h) Evaluation and modification of commercial equipment for irrigation, drainage, subsoiling, tillage, and for conserving soil and moisture in sub-humid areas. (i) Economic evaluation of new equipment.
(AE, AH, FE, FPR)

5.1.2 Forest. (a) Development and testing of equipment for controlling forest fires including aircraft and other machines, portable radio equipment, and that for modifying cloud formation and control of lightning storms. (b) Testing and adaptation of commercially available machines and tools for tree planting, brush cutting, and other cultural work. (c) Testing and development of airplane equipment for applying insecticides and silvicides. (d) Adaptation of airplanes and air photography to estimation of forest resources and insect and disease attacks.
(FFR, FIR, FPR, FMR, FER)

5.2 PROCESSING AND MARKETING

5.2.1 Buildings and facilities. (a) Research on market facilities, including kind, number, and arrangement of buildings, transportation services, location, and financing and operation of assembly point markets, terminal markets, and wholesale food markets for large cities. (b) Design and layout and operation of special warehouses such as refrigerated, cotton, and fruit and vegetable. (c) Improvement of handling and operational practices in grocery warehouses and retail stores, space utilization, and new devices. (d) Improvement of design of processing and marketing facilities such as slaughter plants, oil mills, fluid milk plants, poultry processing plants, feed plants, frozen food lockers, and fertilizer plants. (e) Improvement of small sawmills.
(TF, FPR, FCS)

5.2.2 Equipment. (a) Processing: Improvement and evaluation of equipment for processing cereal and forage crops, fibers, fruits and vegetables, oilseeds, animal products, sugar crops, pine gum, wood, and products derived therefrom. (b) Handling: Testing and adaptation of materials-handling equipment to reduce labor requirements in handling of products in warehouses, processing plants, and marketing channels; development of improved devices for conditioning, handling, and preparing farm products at marketing points, (e.g., apple sizers, automatic container fillers, egg graders, and packing equipment). (c) Packaging: Development of cheaper and improved packages and containers for more efficient handling and to protect products against damage and loss of quality during marketing and processing, including prepackaging fruits and vegetables in consumer-size packages, pallets and palletizing. (d) Transportation: Research on more efficient use of rail equipment and integration of rail, truck and water transportation; testing and improvement of trucks and trailers, refrigeration units, condensation control, insulation, cargo stowage, non-skid flooring, and racks.
(EU, NU, SU, WU, TF, MQ, ME, FCS, FPR, FER)

5.1.1 (a) Expand research on effect of physical environment on livestock production and structures to provide improved environments with reduced handling of feeds. Expand economic and engineering research on livestock buildings and farm storage structures. (b) Expand work dealing with grain drying and storage as related to climatic regions. (c) Expand research on structural design and data and on protection of wood in use; initiate testing of full-scale farm buildings on farm units, and research on improved greenhouses. (d) Expand studies of farmstead engineering for more effective use of electric power for materials handling (especially in livestock production and for conditioning products on the farm); continue work on electric insect traps for survey purposes, but curtail work on use for insect destruction; expand basic research on response of insects to electromagnetic radiation. (e) Expand with emphasis on equipment for soil and water conserving farm practices, for small farms and gardens, establishing grasslands, harvesting and handling fruits and vegetables, irrigation, and application of pesticides and herbicides. (f)-(h) Expand. (i) Expand economic evaluation to go hand in hand with development of new equipment and studies of opportunities for reducing costs of purchased supplies and equipment.

(j) Initiate development of equipment as needed to apply findings of research on uses of electric energy; initiate research on farmstead water supply and sewerage, on equipment for harvesting tobacco and extra-long-staple cotton, on prevention of frost damage to fruits and vegetables, and on ginning of extra-long-staple cotton, including automatic controls for ginning equipment.
(AE, AH, FE, FPR)

5.1.2 (a) Expand with emphasis on use of aircraft and other mechanized suppression systems, and control of lightning storms. (b) Expand to include development of new equipment for timber harvesting on steep, unstable slopes, seedbed preparation, mechanization of pruning and thinning, cone and seed harvesting, and other operations and activities. (c), (d) Expand.

(e) Initiate economic evaluation to accompany development of new equipment.
(FFR, FIR, FPR, FMR, FER)

5.2.1. (a) Expand with emphasis on facilities for marketing, location, kind and size of facilities, economics of scale, and degree of processing and include marketing facilities for livestock and meat, oilseeds, peanuts, tobacco, feed, and wool. (b), (c) Expand. (d) Expand research on facilities for processing dairy, livestock, poultry, fruits, and vegetables with particular reference to economics of scale, to minimize costs, and to design and apprise feasibility of small and medium sized plants. (e) Expand to include development of other processing, such as chipping for pulp.

(f) Initiate research on the effects of new processes and products on location, design, and operation of marketing facilities and on the point in marketing channels where processing should be done (e.g., milling wheat, scouring wool, slaughtering, washing greans, peeling potatoes). Initiate research on the best locations for and kinds of processing plants in areas where new crops are replacing old. (See also Objectives 9 and 14.)
(TF, EU, NU, WU, ME, FCS, FPR)

5.2.2 (a) The development of new and improved equipment for processing farm and forest crops is extremely important from the standpoint of lowering processing costs and improving the quality of products. Research in this area should be expanded. Attention should be given to development of equipment for irradiation of agricultural materials. (b) Expand to include all important farm and forest commodities and more types of handling operations. (c) Expand to include bulk containers, and unitizing for mechanized handling. (d) Expand all aspects of transportation research.
(EU, NU, SU, WU, TF, MQ, ME, FCS, FPR, FER)

OBJECTIVE 6--To develop and adopt those practices in the use and management of agriculture's basic resources of soil, water, forest and range and germplasm of plants and animals that will conserve and improve their capacity to provide needed goods and services with greater profits and fewer disasters to the farmers who utilize them.

The principal purpose of research in these areas is to provide a sound basis for conservation of basic resources and for improvement as needed. Since the problem areas of soil and water are especially interrelated, research in one segment is usually related to and helps that in another. Research in all the areas is fundamental to strong and continuing agriculture and forestry.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

6.1 CONSERVATION AND IMPROVEMENT OF BASIC SOIL RESOURCES

6.1.1 Prevention of impairment. (a) Development of practices to maintain good physical and nutritional condition of soils. (b) Study of factors influencing wind and water erosion, sediment movement, excessive runoff. (c) Development of measures to prevent watershed degeneration, including impairment of soil, prevention of floods and sedimentation. (SWC, AE, WMR)

6.1.2 Rehabilitation and improvement. (a) Development of basis for and testing measures to restore soil resources damaged by excessive runoff and erosion. (b) Development of drainage specifications and practices. (c) Development of irrigation practices and water supplies for humid and dry areas. (d) Correction and control of salt and alkali. (e) Determination of mineral needs to meet deficiencies that limit restoration and improvement of soil. (SWC, WMR)

6.1.3 Soil resource economics. (a) Inventory of land uses, effects of public policies and programs in soil conservation, flood prevention, drainage and forestry. (b) Alternative land tenure arrangements. (c) Benefits and costs to farmers and the general public of soil conservation and flood prevention. (d) Economic forces affecting allocation of soil resources between non-agricultural and agricultural and forestry uses. (FE, FER)

6.1.4 Classification and mapping of soils. (a) Soil morphology, properties, behavior, and other factors relating to proper and useful soil classification. (b) Research on soils and vegetation classification and mapping aimed at more useful systems for forest and related range lands. (SCS, FER, WMR)

6.2 CONSERVATION AND IMPROVEMENT OF BASIC WATER RESOURCES

6.2.1 Hydraulics of structures and stream channels and sedimentation studies. (a) Design of structures, including ditches, dams, training walls, spillways, and including use of vegetation with structures. (b) Development of basic information on movement of sediment as related to water quality and control of excessive runoff. (c) Determining hydraulic characteristics of steep mountain stream channels. (SWC, WMR)

6.2.2 Agricultural watershed hydrology. Studies of effects of different land uses, farming practices, and other measures on the amount, rate, and distribution of surface runoff with respect to flood flow, water yield, soil erosion, and on movement and storage of ground water. (SWC)

6.2.3 Forest and related range watershed hydrology and management. (a) Studies aimed at rehabilitating rundown and damaged watersheds to restore good watershed conditions. (b) Research on preventing watershed degeneration while using lands for timber production, grazing, and other uses. (c) Research on improving water yields, especially from high mountain areas, both as to quantity and seasonal distribution. (WMR)

6.2.4 Water conservation. (a) Studies aimed at conserving water on non-irrigated croplands and on forest and rangelands through increased infiltration and storage of water in soil and reduced evapotranspiration losses. (b) Water quality appraisals in regard to salt content and development of measures to prevent soil impairment or crop injury. (c) Methods of control of aquatic weeds and phreatophytes along water courses and on watersheds. (d) Research on measures to reduce water losses in irrigation works. (SWC, WMR, CR)

6.2.5 Water resource economics. Analysis of present and projected programs with special reference to benefits and costs and to water laws. (FE, FER)

6.3 CONSERVATION AND IMPROVEMENT OF BASIC FOREST AND RANGE RESOURCES. The basic forest and range resources include, in addition to the soil, the growing stock of timber and the forage from which, under proper maintenance and management, the growth may be harvested without impairment of their capacities to supply, at reasonably high levels, a sustained production of timber products and a continuing grazing use while at the same time providing favorable conditions for vital watersheds, essential habitats for wildlife, and required environments for forest recreation.

6.1.1 (a) - (c) Expand with emphasis on basic research on soil behavior, soil-water relations, and erosion control methods. Serious gaps in the research on farm lands occur in the East. Research on forest and related range lands is reasonably balanced geographically but inadequate generally. (SWC, AE, WMR)

6.1.2 Expand all segments but with accent on restoring and improving rather than developing new land resources such as through clearing, irrigation, and drainage areas. (SWC, WMR)

6.1.3 Expand all segments with special emphasis on studies aimed at improving effectiveness of public policies and programs and at guiding allocation of soil resources among major uses. (FE, FER)

6.1.4 (a) Expand to facilitate nation-wide soil survey which is planned to cover most of United States in 15 years. (b) Expand to include additional pilot projects in several forest regions and to include Alaska. (SCS, FER, WMR)

6.2.1 Expand all segments as basis for guidance of soil and water conservation programs. (SWC, WMR)

6.2.2 Expand to achieve better balance geographically and to attack problems in several present locations more adequately. (SWC)

6.2.3 Expand all segments to fill major geographic gaps where important differences in climate, soil, and geology occur, and to strengthen existing projects at present locations. (WMR)

6.2.4 Expand all segments with emphasis on water conservation relative to non-irrigated croplands and to forest and rangelands, and on improved methods of control of aquatic weeds and phreatophytes. (SWC, WMR, CR, ENT)

6.2.5 Expand with emphasis on consideration of alternative water programs. Initiate work on nation-wide water use inventory. (FE, FER)

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
<p>6.3 CONSERVATION AND IMPROVEMENT OF BASIC FOREST AND RANGE RESOURCES--Continued</p> <p>6.3.1 <u>Forest and range protection against fire, insects, and diseases.</u> (a) Studies of combustion of fuels and behavior of fires, development of more effective control measures (such as with chemicals, use of airplanes, cloud seeding to disperse lightning), and improved techniques of using fire as a cultural tool. (b) Forest insect research aimed at preventing epidemics and establishing methods of control. (c) Range insect research emphasizing methods for control of grasshoppers and other insects. (d) Disease research aimed at determining causes of diseases and developing methods of control. (FFR, FIR, FDR, ENT, CR)</p> <p>6.3.2 <u>Forest Management.</u> (a) Studies to improve or develop practices that will protect the forest against depletion and damage to its productivity and to improve productivity to achieve sustained yield of good-quality timber consistent with other desirable uses of the land such as studies on seed, nursery and tree planting methods. (b) Research to improve or develop timber harvesting methods, natural regeneration, cultural practices for young timber stands, forest genetics, and forest soil and physiology. (FMR, FDR, WMR)</p> <p>6.3.3 <u>Forested and non-forested rangelands.</u> (a) Research aimed at range reseeding and control of weeds. (b) Studies of livestock grazing management and big game use. (c) Studies of the relation of livestock grazing to big game use and the relation of timber production to grazing. (d) Development of criteria to judge condition and trend of rangelands. (e) Research on the effect of rodents and their control. (f) Research on range plant identification and breeding of improved range forage plants. (RMR, CR)</p> <p>6.3.4 <u>Forest recreation.</u> Research is in two general areas: (a) biological and physical aspects of management of forest recreation resources, and (b) economic and social aspects of forest recreation. Studies include: carrying capacity of land for recreational use; reciprocal effects of recreation and other forest uses; management methods for recreational use and recreational areas; methods for measuring use; and projections of demand for recreational facilities and use of forest land. (RMR)</p> <p>6.3.5 <u>Forest survey.</u> This activity, through periodic surveys, obtains facts as to area and location of forest lands, volume and character of timber resources, ownership of forest lands, rates of depletion by cutting and destructive agents, rates of timber growth, and future requirements for forest products. (See Objective 3.) (FER)</p> <p>6.3.6 <u>Forest and range economics.</u> Research includes cost-benefit analysis of forest and range conservation and improvements, economics of competitive and multiple use of forest and rangelands, effects of tenure arrangements, forest taxation, insurance and credit. (FER, FE)</p> <p>6.4 CONSERVATION AND IMPROVEMENT OF GERMPLASM</p> <p>6.4.1 <u>Plants.</u> Approximately 25,000 field and horticultural crop introductions are held as living plant material at four Federal introduction stations. These are clonal stock that cannot be held as seed. Each of the regional cooperative introduction gardens hold seed for current programs. The National Seed Storage Laboratory holds germplasm in the form of seed on a long-time basis for future need and also the hundreds (in some cases thousands) of accessions needed by various research groups in active plant improvement programs. Forest tree introductions are held as living plant material at the Federal Forest Genetics Institute at Placerville, California, and watershed material in southern California. Forest tree and other plant material also is held at the National Arboretum. (CR, FMR)</p> <p>6.4.2 <u>Animals.</u> Very little research, other than the Dairy Herd Improvement and the Poultry Improvement programs, is under way on conservation and improvement of germplasm. Some conservation is achieved as byproduct of regular breeding work for improvement. (AH)</p>	<p>6.3.1 Expand all segments, but with relatively more emphasis on fire research because of currently weak program. Emphasis in expanded insect and disease research should be put on chemicals that cause minimum harm to fish and wildlife and that do not leave residues in animal products, and on indirect control through biological means and improved forest management measures developed for this purpose (see 6.3.2). (FFR, FIR, FDR, ENT, CR)</p> <p>6.3.2 Expand all segments of program with emphasis on strengthening research in the entire West and Alaska including: plantation management with special attention to the South and Lake States; regeneration studies both natural and artificial; fertility requirements of various species; and tree improvement involving genetics to improve quality of growing stock and increase resistance to insects and diseases. More basic research is needed in soils, physiology, and genetics. (FMR, FDR, WMR)</p> <p>6.3.3 Expand substantially all segments of program with emphasis on systems and intensities of grazing on major forage types under different soil and climatic conditions. Greatly increase effort on game habitat and dual use of range by livestock and big game. Establish methods of range inventories; develop criteria and methods for judging range condition and trend; initiate nation-wide range inventory. Study revegetation, noxious plant control, and range insects and diseases. (RMR, CR)</p> <p>6.3.4 Expand program substantially to intensify and accelerate research on problems rapidly becoming critical in forest recreation. (FER, FMR, RMR)</p> <p>6.3.5 Expand to provide essential information to guide research programs and to guide policies and programs of public and private action agencies. (FER)</p> <p>6.3.6 Expand program in both forest and range economics. Give special attention to studies of farm forestry, forest land tenure, multiple use of forest lands, place of public ownership, and cost and returns on rangelands. (FER, FE)</p> <p>6.4.1 There is need for expansion in plant improvement research utilizing especially the germplasm being maintained in the new National Seed Storage Laboratory. Land facilities for holding clonal stocks can be expanded. There is need to provide additional regional facilities and arboreta for preservation of non-seed (forest-tree) germplasm. Provision should be made for the operation and development of an adequate National Arboretum. (CR, FMR)</p> <p>6.4.2 Initiate studies on methods of artificially preserving semen and ova, and on methods for importing foreign stocks. Research should be done on means of distributing existing stocks in order to preserve them, and on identification of superior germplasm. It is recognized that this is a difficult, complex field of research and that a substantial program of research would be expensive. Expand the Dairy Herd Improvement and Poultry Improvement programs and initiate record of performance programs for beef cattle, swine and sheep. (AH)</p>

OBJECTIVE 7.--To increase knowledge of insects, diseases, weeds, parasites, fire and other hazards that affect the production and marketing of crops, livestock, and timber and their products; to develop practical methods of controlling, preventing, or reducing losses therefrom; to provide a research basis for minimizing the effects of these losses through insurance or other measures.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

7.1 INSECTS

7.1.1 Biology of insects. Study of the ecology, anatomy, taxonomy, genetics, physiology and nutrition of insects at all stages of development for purposes of identification and understanding of life processes as a guide to research on methods of control for destructive insects. Research on the mode of action of insecticides.
(ENT, FIR)

7.1.2 Control and eradication of insects and prevention of infestations. (a) Study of the chemistry, synthesis, and tests of insecticides, attractants, and repellents. (b) Development of formulations and of equipment for applying insecticides and repellents. (c) Studies of biological methods of control, including predators, parasites, viral, bacterial, protozoan insect diseases, and irradiation. (d) Studies of control of insect damage through increased resistance of plants and animals by breeding and through environmental control and proper handling and storage.
(ENT, ADP, AH, CR, AE, FIR, FMR, HN, CH, TF, RMR, WU, NU, MQ)

7.1.1 Expand work in classification and identification, and in physiology and toxicology with emphasis on mode of action of insecticides. Expand studies on the mechanism of resistance to insecticides. Expand basic research on attractants, growth regulating chemicals and repellents.
(ENT, FIR)

7.1.2 (a) Expand synthesis and testing of insecticides, attractants, and repellents, and develop better procedures for evaluating them. (b) Expand research on preventing or minimizing subsidiary damage from control measures; studies of systematic insecticides; research on ground and aerial equipment for applying insecticides and repellents to control insects of the soil and with insects that are harmful to forests, ranges, crops, ornamental plants and greenhouse crops, stored crops, grocery items, household items, and wood products, and that are pests to animals and man. (c) Expand studies of biological methods of controlling insects, including predators, parasites, and insect diseases (viral, bacterial, protozoan), and the sterile-nale technique. (d) Expand efforts to develop by breeding and selection and to find by exploration, strains of plants and animals that are resistant to insects; studies on improving environmental control; studies of insects as vectors of diseases of both plants and animals; studies of the economic significance of harmful insects and evaluation of control measures and programs.
(ENT, ADP, CR, AE, FIR, FMR, FE, ME, HN, CH, TF, RMR, AH, FER, WU, NU, MQ)

7.2 DISEASES, NEMATODES, OTHER PARASITES AND PHYSIOLOGICAL DISORDERS

7.2.1 Biology of the agent. Studies of ecology, taxonomy, genetics, and physiology of the agent for purposes of classification, identification, and understanding of life processes.
(ENT, FDR, CR, MQ, ADP)

7.2.1 Expand studies of causative agents, emphasizing parasite-host relationship, the origin and pathogenicity of races of pathogens, the relation of the chemistry and enzyme systems of causative agents to their pathogenicity, response of disease agents to chemicals and physical treatments and resistance of plants to pathogens; on growth requirements of the agent and safe methods of preservation, for research purposes, of agents that cause disease; on mechanisms of biological control.
(ENT, FDR, CR, MQ, ADP)

7.2.2 Control and eradication of the agent and prevention of infection or infestation. (a) Studies of occurrence, symptoms, methods of diagnosis, pathology, methods of spread, and treatment, including research on drugs, chemicals, antibiotics, sera, and irradiation to ameliorate or cure disease; on soil fumigants, seed treatments, dusts, sprays, disinfectants, quarantines, crop rotation, and packaging to lessen or prevent exposure. (b) Research on selecting and breeding for resistant strains, testing untested strains for resistance, searching and exploring for untested strains, and developing immunity or resistance by using biologics. (c) Studies on inducing environmental conditions unsuitable for development of harmful agents, and the relation of temperature, moisture, packaging, light, mechanical injury, time, and maturity to damage in transit and in storage by harmful bacteria and fungi. (d) Evaluation of control programs on forest diseases.
(ADP, AH, CH, HN, CR, ENT, MQ, FDR, FMR, RMR, FER, FPR, EU, SU, WU, NU. Control, inspection, and quarantine activities conducted by Department regulatory Divisions)

7.2.2 (a) Expand research on methods of spread, methods of diagnosis, detection of natural hosts that are carriers, economic losses resulting from disease; on the use of antibiotics, especially with plants and plant products; studies of chemical, physical, and biological methods of destroying agents that cause disease. (b) Expand basic studies on the nature of resistance to disease; methods of breeding resistant strains of plants and animals. (c) Initiate research on relation of environment to disease. (d) Expand or initiate research on economic significance and evaluation of control measures and programs.
(ADP, AH, CH, HN, CR, ENT, MQ, FDR, FMR, RMR, FER, FPR, EU, SU, WU, NU, FE, ME, TF)

7.2.3 Control of physiological disorders. Studies on the occurrence, symptoms, methods of diagnosis, cause, prevention and control of disorders of non-pathogenic origin that are a hazard to the production and marketing of crops, livestock and timber. (See also Objectives 9 and 10)
(ADP, AH, HN, CR, MQ, FDR, FMR, FPR, EU, SU, WU, NU)

7.2.3 Expand studies on the causative factors that bring on physiological disorders in the growing plant and the crop itself after harvest. Expand similar studies with animals. Intensify research on methods of control. (See also Objectives 9 and 10.)
(ADP, AH, HN, CR, MQ, FDR, FMR, FPR, EU, SU, WU, NU)

7.3 PREDATORS, RODENTS, BIRDS, AND GAME ANIMALS

Studies to determine management practices that reduce losses to a minimum, development and evaluation of repellents; development and evaluation of poisons and toxins for destruction of rodents and predators; development of protective devices. Much of this work is in cooperation with the Department of the Interior.
(FMR, RMR, MQ, ADP, AE)

Expand both basic and applied research on animal damage and methods of control, including studies of populations, migrations, ecology, and habits of damage-causing mammals and birds. Intensify studies on wild animals as possible reservoirs of disease agents affecting domestic animals. Expand research on repellents and on rodent-proof or resistant containers.
(FMR, RMR, MQ, ADP, AE)

7.4 WEEDS

Research on development, screening, and evaluation of herbicides and physiological mechanism in selective actions of herbicides; ecological requirements and application of findings to control weeds; cultural practices that lead to weed control; biological control of weeds.
(CR, AE, FMR, RMR, ENT)

Expand all phases of research on weeds with emphasis on basic ecological and physiological studies, biological control, good grazing practices and use of fire as control measures, and on prevention of losses of livestock from plant poisoning. Expand research on the economic significance and evaluation of different control measures.
(CR, AE, FMR, RMR, ENT, FE, FER)

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
7.5 WEATHER Studies of heat, cold, drought, humidity, wind, and protection against unfavorable weather conditions during production harvest and marketing; tolerance of plants and animals and selection and breeding of species and strains that withstand extremes in weather. Studies of weather in relation to cultural practices and resulting crop yields. Effects of climate on development of insects. Studies of lightning storms and methods of reducing their forest-fire potential. (SWC, AE, CR, MQ, TF, FFR, FMR, RMR, FDR, ENT)	Expand all phases of present research. Develop cooperation with Weather Bureau to improve weather information for farmers. Initiates research on weather in relation to production hazards and resulting farm income. (SWC, AE, FE, CR, MQ, TF, FFR, FMR, RMR, FDR, ENT)
7.6 FIRE Studies of forest and range fires with methods of prevention and control; impact of forest fires on economic and social values; development of techniques for using fire beneficially in land management. Methods of making buildings, equipment, wood, fabrics, and other materials fire resistant. (AE, SU, WU, FFR, FMR, RMR, FPR)	Expand all work in this field, especially both basic and applied research with forest and range fire problems; fireproofing methods and organized farm fire protection. Expand research on preventing fire losses to buildings, storage facilities, and farm crops. (AE, SU, WU, FFR, FMR, FPR, FE, TF)
7.7 POLLUTANTS OR CONTAMINANTS, AND HARMFUL SPRAYS, DIPS, AND DUSTS Studies of harmful effects on vegetation of air pollutants such as sulfur dioxide, fluorine, chlorine, the organic peroxides, and smog; symptoms of injury and amount of damage done by pollutants; methods of preventing pollution of air. Studies of harmful effects of insecticides, herbicides, and fungicides, and of insecticidal residues in agricultural products. (ENT, CR, ADP, AH, FDR, SWC)	Expand all work with pollutants or contaminants of air, water, feed, and soil; with insecticides, herbicides, and fungicides that are or may be harmful. Initiates work on effects of air pollutants on animals. Initiates economic research on air pollution losses and costs of abatement. Substantially expand research on determination of insecticidal residues in agricultural products. (ENT, CR, ADP, AH, FE, FDR, SWC)
7.8 INSURANCE AGAINST AGRICULTURAL HAZARDS Studies of operation of farmers' mutual fire, windstorm and crop-hail insurance companies; estimates of annual farm fire losses and means of providing organized farm fire protection. (See also Objective 12.) (FE, FER)	Expand all present work. Initiate research on insurance of forests against losses from fire, wind, insects, and diseases; on crop insurance with emphasis on contracts that include complete weather cycles; develop reliable loss patterns for crops and livestock. (FE, FER)

(See page 13 for key to agency symbols)

OBJECTIVE 8.--To be cognizant of national needs in times of emergency, and to develop the research necessary to provide supplies of, or substitutes for, strategic and critical agricultural materials, and for the supply and effective use of other needed farm and forest products, at levels required by the emergency.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

8.1 COGNIZANCE OF AND ABILITY TO MEET EMERGENCY NEEDS--Research must be conducted and other steps taken to assure cognizance of conditions likely to exist during national emergency, the needs for farm and forest products, and the materials and facilities required for their production, processing, and distribution in order to place the Department in position to discharge its emergency responsibilities. Much of the Department's regular research program contributes toward recognizing and meeting these needs. Accordingly, proposed changes in program are confined to those aspects not specifically covered under other objectives or inadequately covered to fully satisfy emergency needs.

8.1.1 Food, fiber, and tobacco. (a) Continuous estimates of civilian per capita needs for and consumption of food, fiber, and tobacco to provide a first approximation of emergency demands on agriculture, processors, and distributors. (b) Study of ways to decrease vulnerability of food, facilities, and stocks to any kind of damage, and to develop emergency processing, storage, and distribution methods. (c) Study of changes needed in the food distribution system to care for evacuees in emergency. (d) Analysis of Government-owned food stocks in relation to potential need. (e) Collection of basic nutrition reference data. (f) Development of more stable, convenient food forms.

(Primary emergency responsibility is with the Food Distribution Division, AMS, and the Food and Materials Requirements Division, CSS; research in AEC, MD, HN, HHE, NU, SU, EU, WU)

8.1.2 Forestry. (a) Continuous estimates of product needs and inventory of forest land and timber supply and related factors to determine ability to meet emergency needs. (b) Studies to improve efficiency of wood-processing methods and find ways of utilizing low-grade species and products as substitutes for high-quality products in short supply. (c) Development of process for production of glycerol from wood to meet emergency needs.

(FER, FPR)

8.1.3 Farming efficiency. (a) Continuous measure of labor input in agriculture to provide basis for emergency needs for producing food and fiber. (b) Estimates of annual consumption of plant nutrients by crops and States. (c) Surveys of farm practices and equipment and cost of handling, harvesting, and spraying. (d) Estimates of consumption of types of feed by species of livestock.

(FE, FPR, SWC)

8.1.4 Material and facility requirements. (a) Continuous accumulation of requirements data for materials and facilities needed for farm and forest products production, processing, and distribution as bases for emergency advice to control agencies. (b) Determination of size of transformers and entrance switch capacities to meet farm electrical demands anticipating emergency.

(FER, FMR, AE, FMRQ)

8.2 NEED FOR STRATEGIC AND CRITICAL MATERIALS--Research is conducted to develop domestic sources of materials deemed strategic and critical by Office of Civil and Defense Mobilization to obviate need for stockpiling to meet emergency requirements. The stockpile list now includes the following agricultural materials: castor oil, coconut oil, cordage fibers, extra-long-staple cotton, hyoscyine, opium, pyrethrum, natural rubber, vegetable tannins, feathers and down, palm oil, quinidine, shellac, raw silk, silk waste and noils.

8.2.1 Fibers. Research on breeding, propagating, and adapting new plant sources, and developing methods of growing, harvesting, and processing abaca, henequen, hemp, sisal, ramie, kenaf, sansevieria, phormium, and extra-long-staple cotton.

(CR, AE, SU)

8.2.2 Vegetable oils. Research on breeding, propagating, adapting, and harvesting castor beans. Research on conversion of castor oil to chemical intermediates and on detoxification and de-allergenization of castor pomace to eliminate processing hazards.

(CR, AE, WU)

8.1.1. (a) Expansion is needed and will be partially met by expansion of research to estimate peacetime needs as part of the program under Objective 1. Additional research, directed specifically to emergency need for information, is required to estimate food inventories of farms, homes, institutions, and in the hands of retail and wholesale dealers and of processors. (b) Develop methods to insure a food supply with no, or minimal, contamination from products of nuclear fallout. Continue other work at present level with attention to essential nonfood agricultural products as well as to food. (c) Continue at level permitted by funds transferred from FCDA. (d) Continue at present level. (e) Nutrition reference data are vital to emergency preparedness and their accumulation should be speeded by expansion of research to develop new knowledge needed as part of program under Objectives 1 and 2. (f) Availability of a greater variety of stable, essential foods is a good preparedness measure and their development should be hastened by expanded research as part of the program under Objective 11.

(AMS, CSS, AEC, MD, HN, HHE, NU, SU, EU, WU)

8.1.2 (a), (b) Expansion is needed and will be met by expansion of research in these areas as part of program under Objectives 3 and 11. (c) Continue at level permitted by funds transferred from Department of Defense.

(FER, FPR)

8.1.3 (a) Expansion is needed and will be met partially by expansion of research in this area under Objective 9. Additional research is needed to determine farm manpower requirements per unit of production for major crops, livestock and various types of farming operation. (b) Expansion needed will be partially met by expansion of research in this area under Objective 9. Additional research is needed to make estimates for emergency use to include the use of fertilizer by types and by crops for different farming areas. (c) Expansion needed will be partially met by expansion of work in this area under Objectives 5 and 9. Additional research is needed on the effects of technological changes on farm production and on the number, age, and type of farm tractors and other farm machines. (d) Expansion needed will be partially met by expansion of work in this area under Objective 9. Additional research needed to estimate feed requirements by major areas.

(FE, FPR, SWC)

8.1.4 (a) Expansion is needed and will be partially met by expansion of research in this area under Objective 3. Additional attention is needed, particularly in FMRQ, CSS, to developing requirements data covering building materials, water distribution equipment, pesticides, electric power, fuel tank capacity, food and fiber processing and distributing machinery and materials, and farm, home, and community food processing equipment and supplies. (b) Expand to develop economical methods and equipment to provide farm electric wiring capacity needed in emergency and to develop standby farm generators. (See also Objective 12.)

(FER, FMR, AE, FMRQ)

8.2.1 Discontinue research on hemp. Expand development of portable decorticator, methods and equipment for retting kenaf; harvester for sansevieria and phormium. Continue other present studies. (See also Objective 5.)

(CR, AE, SU)

8.2.2 Continue development and improvement of harvesting and processing equipment for castor beans and disease-resistant castor beans for humid areas. Expand research on detoxification and de-allergenization of castor pomace. Initiate development of a substitute for coconut oil from domestically available raw materials.

(CR, AE, WU, SU)

OBJECTIVE 8--Continued

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
8.2 NEED FOR STRATEGIC AND CRITICAL MATERIALS--Continued	
8.2.3 Botanical drugs and insecticides. Introduction, culture, and analysis of new plants as sources of nontoxic insecticides and needed drugs, including some classified research. (CR, ENT, NU)	8.2.3 Expand research on rotenone-bearing plants. Reinstitute development of domestic sources of pyrethrum. Investigate the efficacy and nature of insecticidal agents in other botanicals. (CR, ENT, NU)
8.2.4 Vegetable tannins. (a) Introduction and development of canaigre and other potential domestic tannin crops. (b) Development of extraction process for tannins from canaigre. (CR, EU, NU)	8.2.4 (a) Discontinue research on sumac. (b) Curtail work on canaigre extraction process, except that relating to improvement of efficiency of extractions. Expand research to develop tanning agents by chemical modification of domestic agricultural materials in plentiful supply. (CR, EU, NU)
8.2.5 Rubber. Research to maintain stocks of guayule against possible emergency need. (CR)	8.2.5 Continue at present level. (CR)
8.3 MINIMIZING EFFECTS OF ENEMY ACTION AND OTHER NATIONAL EMERGENCIES-- Research is conducted to help the Department discharge responsibilities delegated to it by the Office of Civil and Defense Mobilization in emergency. These are to prepare national emergency plans and develop preparedness programs covering: (1) Food resources; (2) rural fire control; (3) defense against biological warfare, chemical warfare, and radiological fallout as they affect livestock, crops, certain processed foods, and agriculture generally; (4) farm community counseling; and (5) guidance on disaster preparedness to those industries concerned with food processing, distribution, and storage, including coal storage, and with domestic distribution of farm equipment and fertilizer. Research provides the tools for use by regulatory, control, and other action agencies of the Department in national emergencies.	
8.3.1 Biological warfare. (a) Detecting, diagnosing, and controlling plant and animal diseases and injurious insects introduced by enemy action. (b) Direct research assistance to the Department of Defense on specific problems, some classified. (CR, ENT, ADF, NU, WU, EU, SU, MQ, FIR, FDR)	8.3.1 (a) Expansion of appropriate programs covered under Objective 7 will provide acceleration needed to yield information required for emergency control of diseases and insects. Emphasis should be on quick, positive methods of detection, diagnosis, and control. (b) Continue at level permitted by funds transferred from the Department of Defense or at present level if supported by Department funds. (CR, ENT, ADF, NU, WU, EU, SU, MQ, FIR, FDR)
8.3.2 Chemical warfare. Research assistance to Department of Defense on specific problems, mostly classified. (EU, SU, FPR)	8.3.2 Continue at level permitted by funds transferred from the Department of Defense. (EU, SU, FPR)
8.3.3 Radioactive fallout. (a) Study of fallout problems related to agriculture. (b) Equipment and methods for decontamination of agricultural lands contaminated by radioactive fallout. (c) Accumulation and movement of fission products in soils and plants and means of altering the movement. (d) Study of movement of radioactive materials ingested by dairy animals and secreted into milk and means by which deposition in milk can be altered. (e) Removal of radioactive substances from contaminated milk. (f) Development of improved foods for supplying fallout shelters. (g) Study of forest fire behavior, control and suppression techniques. (h) Planning and organizing for emergency forest fire control. (i) Evaluation of textiles for resistance to atomic blast and fire. (Note: Research on fire control and resistance also applicable under Chemical warfare 8.3.2) (SWC, SU, FER, FFR, CR, OA of ARS, FS, AMS)	8.3.3 (a) Continue at present level pending determination with the Atomic Energy Commission and the Department of Health, Education and Welfare of research areas needing emphasis. (b) - (g) Continue at present level or at level permitted by transferred funds or Department funds available for these projects. (h) Expand to implement following objectives: (1) Correlate existing protection agencies in States for maximum effectiveness in control of rural fires from enemy action; (2) organize trained corps of volunteer workers; (3) refine plans to protect areas vital for production of essential products; (4) stockpile material and equipment to operate plans. (i) Continue as cooperation with Department of Defense requires. (SWC, SU, FFR, CR, OA of ARS, FS, AMS)

(See page 13 for key to agency symbols)

OBJECTIVE 9.--To increase efficiency in the production, processing, marketing and consumption of farm and forest products by reducing loss and waste and by developing technological and managerial improvements.

Practically all of the research in the Department bears directly or indirectly on this objective. It includes consideration of plant and animal production; the control of pests, diseases, weeds, and other sources of loss; the management of water and soil resources, farm machinery, structures, and other facilities; equipment and supplies for production and marketing; the utilization of agricultural and forest products, the marketing, processing, transportation, storage, grading, and regulation of plant, animal, and forest products; and the organization and financing of farms and of production and distribution enterprises.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

9.1 TECHNOLOGY OF PRODUCTION OF FIELD, HORTICULTURAL, AND FOREST CROPS

9.1.1 Crop breeding and improvement. Studies on variety or species evaluation; breeding for increased vigor and yield, adaptation to climate; resistance to disease and insects; adaptation for mechanization; plant exploration; introduction and testing of new crops.
(CR, ENT)

9.1.2 Cultural practices; soil and water management and fertilizer technology and use. Studies on land preparation and suitability; fertilizer rates and placement; irrigation and drainage; tillage and cultivation; pest control; harvesting and handling; crop rotation.
(SWC, AE, CR, ENT)

9.1.3 Mechanization and farm structures. See Objective 5.

9.1.4 Crop physiology. Research on mineral nutrition of various crop plants; temperature relations; light responses; seed production; cold hardiness; growth regulators and defoliators.
(CR)

9.1.5 Crop hazards--diseases, insects, and weeds. See Objective 7.

9.1.6 Forest management. Research on methods of regenerating forests; culture and harvesting of forests; development of improved trees through selection and breeding, nutrition and tree physiology. See also Objective 6.
(CR, FMR)

9.1.7 Grazing management. Grazing studies for livestock and game involve optimum intensities, season, and system of grazing for various types of range; improvement of livestock distribution; control of weeds and brush by chemicals, fire, or other methods; procedures for judging range condition; degree of compatibility or competition between livestock and game; practical procedures for revegetation; ecological and physiological characteristics and requirements of range plants basic to sound management; compatibility of game production with range and forest management.
(AE, CR, AH, RMR, FMR)

9.1.8 Watershed management. See Objective 6.

9.1.9 Forest hazards--fire, insects, and diseases. See Objective 7.

9.2 TECHNOLOGY OF PRODUCTION OF ANIMAL, DAIRY, AND POULTRY PRODUCTS

9.2.1 Breeding improved types. Research on the development of economically useful characteristics of every class of livestock and poultry; comparisons of systems of breeding; development of inbred lines and effects of combining these lines and cross-breeding to introduce desirable characteristics; development of selection indices and determination of heritability of desirable characteristics; studies on the extent to which environment may affect genetic expression.
(AH)

9.2.2 Nutritional requirements and physiology. Research on the determination of mineral and vitamin requirements of poultry, swine, cattle, and other animals for growth, fattening, lactation, reproduction, and other economic traits. Research to identify still unidentified nutrients; on relationship of nutritional deficiencies to metabolic or other diseases; on relation of soil fertility to nutritive properties of crops; on ability of feeds or rations to meet requirements of livestock; on the development of more accurate techniques for the evaluation of feeds; on the physiology of reproduction, sterility, egg production; and function of hormones; on rumen function and the microbiology of the rumen; on the effect of climate on livestock; on the development of physiological and anatomical indices as a basis of selection for livestock improvement. See also Objective 2.
(AH, AE, CR)

9.1.1 Expand basic and applied research in genetics, cytology, and pathology, and in physiology, morphology and biochemistry as related to breeding. Expand breeding for resistance to insects and nematodes and to new diseases, for higher quality, and to reduce processing losses. See also Objective 7.
(CR, ENT)

9.1.2 Expand basic research in soil chemistry directed toward increasing the proportion of nutrients in the soil available to plants; on mechanism of plant nutrient uptake; on efficient use of fertilizer; on the development of fertilizers for special cultural practices; on irrigation practices, seed production of forage and other crops; and on the relation of cultural practices to crop quality and other factors.
(SWC, AE, CR, ENT)

9.1.3 See Objective 5.

9.1.4 Expand basic research on all phases of crop physiology, including adaptation of crop plants and means of reducing crop production losses.
(CR)

9.1.5 See Objective 7.

9.1.6 Expand basic research to develop more positive regeneration techniques; to determine optimum stocking standards for managed forests. Expand research on breeding and improvement of forest tree species; on tree physiology and nutrition. See also Objective 6.
(CR, FMR)

9.1.7 Expand research to develop basic principles and practices for improving range management and intelligently integrating game and livestock grazing on ranges used by both; to determine effect of range management practices on water yields and soil stability; to develop more economical methods for control of undesirable plants; to develop more efficient methods of range revegetation and fertilization; to conduct fundamental ecological and physiological research on range plants; to develop superior grasses and legumes for ranges; to carry out economic analysis of profitable systems of forage production, involving labor and machinery, and including pastures and ranges, and systems of grazing. Expand research on compatibility of game production with range and forest management.
(AE, CR, AH, RMR, FMR, WMR)

9.1.8 See Objective 6.

9.1.9 See Objective 7.

9.2.1 Expand breeding studies with emphasis on fundamental genetic studies, including development of physiological and physical indicators related to growth, lactation, carcass quality, egg production, and wool production, that can be used for a more detailed study of inheritance.
(AH)

9.2.2 Expand basic physiological research on reproduction. Expand research on the anatomical and histological characteristics of the reproductive tract in relation to reproductive activity; on the chemistry and metabolism of hormones and their role in physiological processes; on rumen physiology; on the bacteriology of and fermentation in stored feeds; on the characterization of the chemical constituents of animal feeds and their relation to nutritive value and metabolic function; on energy metabolism; on soil-plant-animal relationships. Expand research on chemical additives in feed with respect to feed utilization, animal production and health. See also Objective 2.
(AH, AE, CR)

OBJECTIVE 9--Continued

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
9.2 TECHNOLOGY OF PRODUCTION OF ANIMAL, DAIRY, AND POULTRY PRODUCTS--Continued	
9.2.3 <u>Control of diseases and parasites.</u> See Objective 7.	9.2.3 See Objective 7.
9.2.4 <u>Management practices; labor efficiency and farm buildings.</u> Research to determine methods of reducing costs of production of livestock feeds; improve the quantity and quality of feeds produced per unit of land; improve pastures and range-lands for forage production; develop methods of management of pastures and rangeland; explore possibilities of irrigation, harvesting and storage methods to reduce costs and losses of nutrients; develop labor saving machinery; design and study use of improved feeding and livestock handling systems; design and test more efficient and less costly structures for shelter of livestock and for storage of feed supplies. See also Objective 5. (AH, CR, AE, SWC, FE)	9.2.4 Expand research on breeding of forage crops for pastures and rangeland; on developing better methods for seeding; on improving and developing methods for the control of undesirable plants; on efficiency and practicability of irrigation; on determining chemical changes in feeds after harvest. Increase effort on labor saving equipment and farm structures with special attention to family size farms. Expand research on the more effective use of electricity; on the effects of physical environment on livestock; on the management of rangelands through grazing control; on herd management to increase efficiency in the use of labor and in livestock production. See also Objective 5. (AH, CR, AE, SWC, FE)
9.3 ECONOMICS OF FARM AND FOREST PRODUCTION	
9.3.1 <u>Analysis of input-output relationships.</u> Studies to show how output of products changes with different combinations of resource inputs; to determine what are the most efficient or profitable combinations to use on farms under different situations with regard to prices of products and production conditions. (FE)	9.3.1 Expand studies on input-output relationships, indicating quantities and kinds of different resources used in the production of different farm products in different areas. (FE)
9.3.2 <u>Farm organizations and operation to improve net income.</u> Research using results of studies on input-output relationships (see 9.3.1) to indicate changes in the organization and operation of farms and the adjustments in the production and resources use that become profitable and are needed to improve the economic efficiency of production with changing conditions. See also Objectives 4 and 13. (FE, AE, SWC)	9.3.2 Expand economic studies of profitable adjustments in farming and opportunities for increasing production efficiency in view of prospective changes; economic analysis of the opportunities for using improved buildings and machinery. Program needs to be greatly expanded to cover more types of farms, and to indicate how aggregate production of the different farm products can be better adjusted to market demand. See also Objectives 4 and 13. (FE, AE, SWC)
9.3.3 <u>Obstacles to improvement of production.</u> Studies of how institutional arrangements relating to sizes of farms, capital accumulation, availability and terms of credit, land tenure and leasing arrangements can be modified to help achieve greater production efficiency. See also Objective 4. (FE)	9.3.3 Expand economic studies that emphasize ways of overcoming obstacles to improvement. See also Objective 4. (FE)
9.3.4 <u>Measures of current changes in farming.</u> Studies are conducted on a national, regional, and individual farm basis and include: (a) farm output (total production and by commodity groups); (b) input of resources used in farm production including land, labor, machinery, and supplies; (c) measures of production efficiency on farms including crop production per acre, livestock production per unit of feed consumed, production of different crops and livestock per hour of farm labor, and farm production per unit of power, machinery, and equipment used. See also Objectives 3 and 8. (FE)	9.3.4 Expand all aspects of present program. See also Objectives 3 and 8. (FE)
9.3.5 <u>Forest economics.</u> Studies on economic phases of forest management including timber and forage production and involving studies of forest taxation, credit, and insurance, forest ownership, economics of alternate land uses, and evaluation of individual practices and combinations. (PER)	9.3.5 Expand research to determine costs and returns from forest and range management practices and programs under different conditions of climate, soils, ownership. (PER)
9.4 MARKETING OF FARM AND FOREST PRODUCTS	
9.4.1 <u>Pricing and transfer of ownership.</u> See Objective 14.	9.4.1 See Objective 14.
9.4.2 <u>Physical movements of goods.</u> Analysis of price margins at the successive stages of marketing, of costs for the functions performed, and of factors affecting these costs. Engineering-economic studies to develop new or improved practices in handling of products during assembling, transporting, storing, processing, distributing, and related operations (including the harvesting of forest products) in order to make efficient use of labor, machinery and equipment, and facilities. Analysis of economics of scale and of alternative technologies for specific operations. Studies to improve the management of operations; development of methods and practices for preventing losses through breakage, waste and spoilage and for maintaining product quality in marketing channels. See also Objectives 5, 7, 10, and 14. (TF, ME, MQ, FCS, ENT, FMR, FPR, FER)	9.4.2 Expand research in this problem area to include more commodities and more types of operations at all stages of marketing, with increasing emphasis on reducing costs and later stages of marketing, and including ways in which farmers' marketing cooperatives as well as non-cooperative firms can improve efficiency of operations. Initiate or expand studies of economics of vertical and horizontal integration, better coordination of transportation as between the different types of carriers, comparative advantages of different locations for processing and storage and for performance of such operations as packaging in consumer-size containers. See also Objectives 5, 7, 10, and 14. (TF, ME, MQ, FCS, ENT, FMR, FPR, FER)

OBJECTIVE 9--Continued

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
<p>9.5 UTILIZATION OF FARM AND FOREST PRODUCTS</p> <p>9.5.1 <u>Farm products.</u> Research on improvements in the efficiency of processing cereal and forage crops, fibers, fruits and vegetables, oilseeds, sugar crops, animal products and pine gum by the development of new processing equipment and techniques. See also Objective 11. (EU, NU, SU, WU)</p> <p>9.5.2 <u>Forest products.</u> Research on alternative methods of harvesting and transporting timber; on improvement of saw and other woodworking machinery and mills; on the development of more rapid and effective seasoning methods for timber; on the development of more effective treatment methods for protecting wood and wood products from destructive agents; on the design and testing of cheaper and more efficient small charcoal kilns including improved controls; on improvements in design of pallets. See also Objectives 5 and 11. (FPR, FDR)</p>	<p>9.5.1 Expand present program as a contribution to lowering costs of processed products and of raw materials for industrial use. See also Objective 11. (EU, NU, SU, WU)</p> <p>9.5.2 Expand with emphasis on harvesting, transportation, and processing equipment for small forest properties; methods and equipment for continuous pulping and chemical conversion; on seasoning and drying of wood. See also Objectives 5 and 11. (FPR, FDR)</p>
(See page 13 for key to agency symbols)	

OBJECTIVE 10.—To identify, maintain, and enhance the quality of farm and forest products through development of improved production, processing, grading, marketing, and household practices.

Improvement in the quality of farm and forest products, and better adaptation of them to the varied demands in the market, offer an opportunity for agriculture to utilize more fully its productive resources without the consequence of price-depressing surpluses. Relatively greater emphasis should be given to this objective in research in comparison with the objective of merely increasing physical output. To be effective in benefitting producers and users, the research must be concerned not only with farm and forest production but also with maintenance of quality in processing and marketing channels and with end-use practices that take fullest advantage of the different qualities of products. It must also emphasize identification of quality in the market so that buyers can select the products best suited to their needs, and so that prices will reflect proper premiums for product quality.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
10.1 FARM AND FOREST PRODUCTION	
10.1.1 Hereditary improvement of crop plants and animals. Research on breeding to increase specific quality characteristics, e.g., physical and chemical characteristics of cotton, resistance of forage crops to disease and insects, baking and milling qualities of wheat, quality of fruits and vegetables for fresh and processed markets, early and late flowering of ornamentals, straight trunks and figured grain in forest trees, oil content, color, and physical composition of oil crops. Research to develop new breeding techniques for livestock. (CR, ENT, AH, ADP, AE, FMR, FPR, FDR, FIR)	10.1.1 Expand research on relation of cotton quality and yield; protein in hard red winter and spring wheats; improvements in Pacific Northwest wheats for export; protein content and other characteristics (in addition to oil content) of oilseed crops; better wood quality of trees and resistance to factors that lower quality; development of forage crop varieties that are resistant to insects as well as to disease and initiate similar studies on other crops. (See also Objective 7.) Give greater emphasis to basic research in defining quality; in developing new techniques to aid in breeding, selection, and testing forage crops, tobacco, cotton, fruits, vegetables and ornamentals; in studying genetics of quality (protein, starch, oil, minerals in cereal crops; vitamins in corn, sorghum grains, oats). Expand research in animal breeding to develop new breeds and strains better adapted to particular uses. (CR, ENT, AH, ADP, AE, FIR, FPR, FDR, FMR)
10.1.2 Cultural and management practices. Research on factors influencing product size, reducing defects, altering physical, chemical, and other quality characteristics through such means as altering diets of animals and adding antibiotics and hormones; on fertilizing crops, spraying fruits with hormones, pruning and controlling competition of forest trees; on the physiology and development of plants in response to nutrition, climate, soil, light, and other environmental factors. (CR, AH, AE, SWC, FMR, FPR)	10.1.2 Emphasize research on basic physiology of response of plants and animals to environmental factors; to provide a better understanding of forest management problems and to facilitate field trials of practices that lead to forest products of better quality. Initiate research on economic aspects of production practices. (CR, AH, AE, SWC, FMR, FPR, FE)
10.1.3 Control of diseases, insects, and other pests. See Objective 7.	10.1.3 See Objective 7.
10.1.4 Harvesting and farm preparation. Development of harvesting equipment designed to reduce cuts, bruises, and foreign matter in products; improvement of farm sorting, grading, chilling, and packaging and farm facilities for drying and storage of grain. See also Objective 5. (AE, CR, FPR, FER)	10.1.4 Emphasize research on quality aspects in harvesting crops and forest products and preparing them for market, including mechanical harvesting of forage crops, fruits and vegetables; maintaining quality of new longer-staple cottons; the effects of bucking on the quality of timber; the effects of weather on the curing of forage crops. Initiate research on economic aspects of equipment and methods. (AE, CR, FPR, FER, FE)
10.2 PROCESSING AND MANUFACTURING	
Identification and measurement of quality characteristics as a guide in processing procedures and in the development of new and improved products and new and improved processing methods. Conversion of perishable crops to stable products retaining desired original qualities and enhancing them by additional properties imparted by processing. Making products whose characteristics are completely different from those of the original commodity. Maintaining and enhancing quality through processing, manufacturing end-items and use adaptation. See also Objective 11. (EU, NU, SU, WU, FPR)	Program changes needed in this problem area are described under Objective 11. Increased emphasis should be given to quality aspects in research on processing. Research on seasoning of lumber and improved machining of lumber used in manufacture should be expanded. (EU, NU, SU, WU, FPR)
10.3 MARKETING	
10.3.1 Handling, transportation, storage, packing and packaging. Reducing loss in quality due to aging, disease and insect damage, bruising and breakage, through improved handling, transportation and storage of products from point of farm sale to the consumer, e.g., loading of watermelons to prevent cracking and spoilage, irradiation and chemical fungicides treatment of citrus fruit to reduce decay and wax applications to reduce shrinkage, determination of optimum storage temperatures, development of forced air drying equipment for grains and peanuts to reduce spoilage and insect infestation, use of polyethylene film box layers to control ripening of pears, packaging frozen turkeys, ice-packing of poultry, controlling insect infestations in storage, wet storage of logs, fungicide application to lumber. Determining nature and cause of spoilage and deterioration in market channels, e.g., in poultry and eggs, post-harvest physiology and pathology of fruits and vegetables, effect of moisture on germination of seed in storage. See also Objective 7. (MQ, TF, ENT, ME, FPR, FDR, FIR, WU)	10.3.1 Expand research on effects on product quality of conditions such as temperature, humidity, and transit shock and vibration in handling and transportation; on maintenance of quality in storage, transportation, handling and packaging of poultry and eggs, including studies of microbial deterioration; on post-harvest diseases of fruits and vegetables and their physiology in relation to packaging, storage, transportation, and extension of shelf life; on market practices to prevent spoilage and preserve quality in cereals and grain during storage, transportation, and handling, including problems of post-harvest diseases; on durable moth-proofing treatments to protect fibers in storage; on tree-length logging and related practices to maintain and improve quality of forest products; on new procedures for preventing insect infestation in grain, and avoidance of residue problems; on insects in dried fruits in storage; on applications of irradiation for crop and product preservation; on better methods for measuring quality losses, including the appraisal of subtle and slight flavors, odors, and other organoleptic changes that adversely affect value of farm products. Increased emphasis is needed on economic aspects of improved practices. (MQ, TF, FPR, ENT, ME, FDR, FIR, WU, PCS)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

10.3 MARKETING--Continued

10.3.2 Market preferences, sorting and grading, and price-quality relationships. Identification and measurement of product characteristics as a basis for sorting, grading, handling, and otherwise identifying quality, e.g., development of objective measures of cotton strength, of color of tomatoes, of tenderness in peas and meat, of maturity or ripeness in citrus and other subtropical fruits, of grades for forest products. Economic research to determine where boundaries between grades should be placed to maximize grower returns. (See also Objective 2.) Research on consumer preferences as a guide to sales promotion; on retail price reporting on a price-quality basis; on ways to assist consumers in selecting fruits, vegetables, and meats best suited for specific purposes.
(MQ, ME, MD, HN, HHE, FPR, FER, Service Divisions of AMS)

10.4 HOME AND INSTITUTIONAL USE

10.4.1 Product quality identification. Determination of characteristics required to make products suitable for specific end uses, and methods of measuring or evaluating such characteristics. (In foods these include nutritive value, cooking, and eating quality, and stability; in fabrics, launderability, strength, dimensional stability, color fastness, resistance to abrasion and tearing of different types of fabrics, fiber and yarn compositions, construction and finish.) Determination of effects of production, marketing and processing on such qualities in products produced and handled under controlled or known conditions. Development of methods for evaluating cooking characteristics of food products for various purposes. Serviceability in use of fabrics in relation to laboratory tests.
(HN, HHE, CH, MQ)

10.4.2 Household processing and care. Food: Development of methods of home processing, handling, and storage to maintain or retain qualities of importance (nutritive value, flavor, color, appearance). Research on pre-treatment and handling in home canning and home freezing to maintain color, texture, and palatability (fruits, vegetables, meats, poultry products). Research on food preparation and recipe development to provide guides for improving diets and school lunches. Determination of food characteristics as affected by kitchen practices and preparation methods. Quality of raw and cooked fruits and of cooked vegetables as determined by palatability, chemical and histological studies. (See also Objective 12.)

Textiles: Methods for home construction and maintenance of quality of fabrics in consumer use and reconditioning; bacteriological, chemical, and physical research on the nature of fabric deterioration; the effect of detergents, bleaches and other agents used in home laundering and other methods of reconditioning.
(HN, HHE, CH, ENT, MQ)

10.3.2 Emphasize research in support of marketing service programs to develop research-based standards for grades and in solving problems of grading and inspection according to these standards. More economics studies are needed of ways to make quality identification more effective in buying, selling and pricing at all stages of marketing, and of the actual effects of quality improvement programs on returns to farmers. A systematic program should be undertaken, commodity by commodity, to appraise opportunities to expand demand, both domestic and foreign, through improvement of quality and better adaptation of products to buyers' wants. This will require more adequate statistical data on price-quality relationships as a basis for demand analysis.
(MQ, ME, MD, HN, HHE, FPR, FER, PCS, Service Divisions of AMS)

10.4.1 Expand research on quality identification with emphasis on: tests with consumers and industry as to suitability of products for end use; development of means by which consumers can identify quality differences at point of retail sale; fundamental research on sensory testing panels (physiological and psychological factors, standardized procedures, improved statistical methods, improved screening of panel members, derivation of accurate and efficient procedures); physical, chemical, and histological analyses to parallel sensory evaluations of quality; nationwide surveys of household practices and food and fabric qualities desired by consumers, for correlating laboratory measures and judging panels with them.
(HN, HHE, CH, MQ, ME)

10.4.2 Expand research in all aspects, including fundamental studies on standardizing methods of cooking and other processing of the types of products found in present-day markets. Expand research, especially on fabrics, to include modern wash-wear and other functional finishes on cotton, wool, blended, or competitive fabrics, and on household equipment to include common practices for use and care.
(HN, HHE, CH, ENT, MQ)

(See page 13 for key to agency symbols)

OBJECTIVE 11.--To develop profitable new and improved uses and market outlets for farm and forest products, and profitable new crops and types of livestock.

The research described under this objective is concerned specifically with the development of new and improved products. Other research that contributes to this objective is described under Objectives 1, 2, 5, 9, and 10.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
11.1 TECHNOLOGY OF UTILIZATION	
11.1.1 Cereal grains. (a) Industrial uses: Research on processing methods, development of new products, such as chemical conversion of starch into plasticizers and anti-oxidants, and production of industrial chemicals and antibiotics by fermentation. (b) Feed uses: Research on the use of microorganisms to increase the feed value of grains by the production of essential amino acids. (c) Food uses: Improvements in milling and baking quality, and freezing preservation of bakery products. (d) Chemical and physical composition studies and basic research on chemical derivatives of starch and protein to aid development of new uses. (NU, SU, WU)	11.1.1 (a) Expand research on the development of chemical derivatives of starch suitable for use in industrial products such as paper, textiles, and plastics. (b) Expand research on the use of microorganisms to produce polymers having plastic or elastic properties, and to increase content of amino acids of high nutritive value in feeds. (c) Continue present studies. (d) Expand composition studies and basic research on starch and protein derivatives to aid in the development of new industrial and feed uses for corn, wheat, and rice. (NU, SU, WU)
11.1.2 Forage crops. (a) Studies of constituents that have specific accelerating or retarding effects on growth and well-being of livestock. (b) Preservation of carotenoid substances in alfalfa during processing and storage. (c) Composition studies on sorghums. (NU, WU)	11.1.2 Continue present studies.
11.1.3 Cotton. (a) Studies to determine the relationship of fiber properties to processing performance and product quality. (b) Development of improved textile equipment and processing techniques to provide better methods of opening and cleaning cotton at the mills, to produce more uniform picker laps and spin more even yarns, and to produce special fabrics for clothing, home and industrial uses. (c) Development of chemical treatments to give cotton fabrics new and improved qualities, such as wrinkle, heat, rot, weather and flame resistance. (SU, CH)	11.1.3 (a) Expand studies to relate fiber properties and yarn and fabric structure to fabric qualities. Expand research on the development of special products for specific end uses and the development of criteria of end-use quality or performance. (b) Expand mechanical processing studies for the purpose of lowering costs, improving product quality, and developing new end-use products. (c) Expand research on cotton chemical modification and additive treatments to impart new qualities and service life to cotton products. (SU, CH)
11.1.4 Wool. Development of chemical treatments to give wool products new and improved qualities, such as resistance to yellowing, acid and alkali degradation, damage by moths and other insects, and shrinkage. Research on the mechanical processing of wool to improve yarns and fabrics and lower processing costs. Research on better utilization of wool scouring wastes. (EU, WU)	11.1.4 Expand the development of chemical and mechanical processing treatments to give new and improved qualities to wool products and provide new and expanded markets. Initiate pilot-plant studies to aid in the commercial adoption of new processes developed in the laboratory. Discontinue research on utilization of wool scouring wastes. (WU, EU)
11.1.5 Fruits and vegetables. Improvement of texture, color, and flavor in frozen fruits and vegetables. Development of juice concentrates with improved qualities from citrus fruits, deciduous fruits, and peaches. Development of powdered juices from lemons, grapefruit, pineapples, grapes, apples, cherries, and tomatoes; purees from plums, peaches, lemons, and oranges. Studies of new equipment and processing methods for fruits and vegetables, including dehydration and dehydrofreezing. Improvement in the quality and stability of the processed products. Studies on the use of antibiotics in food preservation. Basic research on composition. (EU, SU, WU, MQ)	11.1.5 Intensify composition research and studies of physical and chemical changes causing loss of freshness in fruits and vegetables. Accelerate the development of more attractive processed forms of fruit and vegetable products. Accelerate the development of improved processing methods for fruits and vegetables, with particular emphasis on the production of stable and concentrated forms that do not need expensive packaging. (EU, SU, WU, MQ)
11.1.6 Oilseeds and animal fats. (a) Food uses: Research on improved processing techniques for separation of oil and meal, improved quality and stability of the oils, and food uses for oilseed meals. (b) Feed uses: Improvement in the nutritive value of oilseed meals and elimination of toxic factors. (c) Industrial uses: Chemical modification of vegetable oils and animal fats for use as plasticizers, coatings, detergents, lubricants and other industrial products. Utilization of the waste products of rendering plants. (NU, SU, WU, EU)	11.1.6 (a) Expand research on the stability of liquid food oils and the development of edible coatings by chemical modification of the oils. (b) Expand research to improve the feed value of oilseed meals. (c) Expand research on developing chemicals from oils for use in paints, plastics, lubricants, detergents, coatings and other industrial products, giving attention also to the development of improved processing methods. (NU, SU, WU, EU)
11.1.7 Sugar, sirups, and honey. (a) Sugar beets: Studies on the identification of colloidal constituents that interfere with the extraction and purification of sugar, and processing studies in pilot-plant extraction equipment. (b) Sugarcane: Processing studies to reduce costs and improve recovery of sugar; analytical studies to determine processing efficiency; pilot-plant studies to determine suitability of new varieties for processing, and development of ion-exchange processes for purification of sugar. (c) Maple sap: Development of new and extended uses of maple products; studies to intensify maple flavor; development of methods for producing higher quality sirup and reducing processing costs. (d) Honey: Development of new products containing honey and development of improved methods for determining honey quality. (EU, SU, WU)	11.1.7 (a) Continue research on the colloidal constituents of the beet and the extracts thereof. Initiate studies on the enzymic transformations that cause loss of sugar between harvesting and processing. Initiate research to develop industrial uses for chemical derivatives of sugar. (b) Continue research to improve processing efficiency. (c) Continue present programs. (d) Continue present programs. Develop a practical process for dehydrating honey. (EU, SU, WU)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

11.1 TECHNOLOGY OF UTILIZATION--Continued

11.1.8 Dairy products. Development of a stable, readily reconstitutable whole milk powder. Improvement of dried skim milk for use in baked goods, particularly bread. Improvement in methods of making Cheddar, Swiss, and other cheeses. Improvement in the acceptability of butter through broadening its range of spreadability and prolonging its retention of pleasing flavor. (EU)

11.1.9 Poultry products. Studies of the changes in texture and flavor in frozen, frozen cooked and chilled poultry. Studies of the biochemistry of *Salmonella* and its control in eggs by irradiation. Development of improved procedures for drying egg solids and basic studies of lysozyme. Improvement in the process of converting feathers to animal feed. (WU)

11.1.10 Meat. Studies of meat freezing to prevent shrinkage and fat oxidation during freezer storage. Research to improve the curing of hams and determine the contribution to ham flavor of fermentative microorganisms present in curing brines. Studies of the reactions of fat and of protein in sausage manufacture. (EU)

11.1.11 Hides, skins, and leather. Basic research on hide proteins and research on the chemical treatment of hides to develop new leathers and faster tanning processes. (EU)

11.1.12 Tobacco. Research on the characterization of the constituents of tobacco and tobacco smoke. (EU)

11.1.13 Agricultural residues. No current program of research.

11.1.14 Forest products. (a) Wood and wood-derived products: Research to find new outlets for low-grade forest products such as defective trees and little-used species. Development of improved processing techniques for low-quality timber to reduce waste and produce products formerly made from large trees. Research to find new uses for logging and milling residues or wastes. Basic research in the field of wood chemistry to assist in the chemical modification of wood products and in the production of industrial chemicals from wood. Development of improved methods for pulping wood. Processing studies in the field of veneer production, particularly in the processing of low-grade logs into high-grade veneer and plywood. Research on the use of wood and paper products in packaging. Research on paints and finishes and the treatment of wood with preservatives and fire retardants to improve its appearance and service life. Studies of engineering principles and design. (b) Gum naval stores: Research on improved methods for processing pine gum. Modification of gum rosin, resin acids and turpentine and its constituents to produce chemicals that have application in protective coatings, plastics, rubber, detergents, additives, and other industrial products. (RPR, SU)

11.2 ECONOMICS OF UTILIZATION

11.2.1 Economics of processing and new product development. Analysis of potential markets for new or improved products, both those under development, and as a guide in planning product development research. Market testing of new products. Economic and methods-engineering efficiency studies in processing development and improvement. (EU, FER, FPR, MD, NU, ME, AEC, SU, TF, WU)

11.1.8 Intensify research to develop a stable dried whole milk that can be readily reconstituted. Expand basic research on the interaction of milk components during the manufacture of milk products. Expand research on the structure of milk proteins and the changes that take place during processing and storage. Curtail research on cheese. Initiate research on processes for removal of radioactive materials from milk. (EU)

11.1.9 Intensify research on the prevention of deterioration in precooked frozen poultry meat products. Initiate research to improve processing methods for dried egg white. Expand research to produce dehydrated whole egg that can be reconstituted more easily. Accelerate research to develop improved defeathering, chilling, and freezing methods for poultry. (WU, TF)

11.1.10 Intensify research on the development of processes for improving the tenderness and palatability of low-grade beef. Expand research on development of new meat products. Initiate research on the keeping quality of bacon. (EU)

11.1.11 Expand research to develop improved leather that is resistant to acid deterioration, water penetration, and abrasive wear, including research with tanning agents derived from domestic agricultural sources. Expand basic research on the composition and chemical and physical properties of hide proteins. Initiate the development of hide glues of improved adhesive strength, gelling time, tackiness, and water resistance. Accelerate studies on the enzymatic dehairing of hides. (EU)

11.1.12 Expand research on the chemical composition of tobacco and tobacco smoke and the changes in composition that occur during the curing, fermenting, and aging of tobacco. (EU)

11.1.13 Continue to give technical assistance to the strawboard and corncob grinding industries based on knowledge accumulated in past programs. (NU)

11.1.14 (a) Expand research to improve the production of veneer and plywood and utilize low-grade species. Expand research on the production of industrial chemicals from wood. Expand studies on the pulping of wood with particular attention to the possibilities of blending pulps of various species. Expand research to find new uses for logging and milling residues including byproducts available from chemical conversion processes. Expand research on the use of wood and paper for containers, with particular attention to low grades of lumber. Expand basic studies on the drying characteristics of wood. Expand research on the development of fire retardants for wood, particularly those that are not water soluble. Expand research to develop industrial uses for lignin. Initiate studies to develop new uses for bark. (b) Continue research on the chemical modification of rosin and turpentine and their constituents, to produce new chemicals for industrial use. Continue research on the development of improved gum rosin and formulations for existing uses, such as paints, varnishes, and paper sizing. (c) Initiate studies to develop new uses for tall oil and products derived therefrom. (RPR, SU)

11.2.1 Expand research in this area to more adequately complement technological research in processing and product development. (EU, FER, FPR, MD, NU, ME, AEC, SU, TF, WU)

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
11.2 ECONOMICS OF UTILIZATION--Continued	
11.2.2 Development of markets for present products. (a) Domestic markets: Surveys of family, institutional, and industrial consumers' practices, attitudes, and opinions to guide production, processing and marketing programs. Studies of competitive position of products, and of size and makeup of present and potential markets and factors affecting increase or decrease in use. Research to increase effectiveness of merchandising and promotion. (b) Foreign markets: Collection of information on foreign production and international trade. Analyses of markets and agricultural programs by countries. Appraisals of foreign policies and programs for agricultural development. Continuous analyses of production and consumption by countries. Analyses of preferences for particular products and qualities. (CH, FAS, FER, FPR, HHE, MD, ME, AEC, EU, NU, SU, WU)	11.2.2 (a) <i>Expand</i> with emphasis upon consumption patterns, consumer potentials, and evaluations of advertising and promotional activities. (b) <i>Expand</i> research in this area with particular emphasis upon analyses of: foreign government programs on production and trade; trade agreement programs and U.S. programs to promote sale of farm products abroad; responses of foreign production and consumption to changing prices in world markets for various commodities; means for meeting competition from foreign produced commodities, and obtaining greater access to foreign markets; preferences for particular products and qualities. (FER, FAS, AEC, CH, FPR, HHE, MD, ME, EU, NU, SU, WU)
11.3 NEW CROPS	
11.3.1 Plant exploration and introduction. Plant explorations are made to obtain from all parts of the world, useful or promising plants. These are used directly in the development of new crops for diversification or expansion to meet economic needs, or as material to be used by plant breeders, especially as related to the development of disease-resistant and insect-resistant farm and forest crops. (FDR, FMR, CR)	11.3.1 <i>Expand</i> organized botanical studies with emphasis on the search for alternate crops as economically feasible replacements for those in surplus. (FDR, FMR, CR, FE)
11.3.2 Evaluation and screening of new plants. New introductions for farm and forest crops are evaluated at several regional cooperative introduction gardens and several Federal locations. Introductions are grown in these varied environmental conditions in order to determine factors such as hardiness and resistance to diseases and insects. Whenever feasible, arrangements are made, through cooperation with State Agricultural Experiment Stations and other agencies, to undertake evaluation of new plants on a regional basis for specific crops. Research is also conducted on the chemical composition of new plant introductions for the purpose of determining potential uses. (CR, FDR, FMR, NU)	11.3.2 <i>Expand</i> research on evaluation and screening of plant introductions with emphasis on farm and forest plants that might have potential as new crops and possess disease and insect resistance. Initiate economic research to determine relative profitability of crops under consideration. <i>Expand</i> research on determination of chemical composition of new plant introductions. (CR, FDR, FMR, NU, FE)
11.3.3 Maintenance of germ plasm. Approximately 25,000 field and horticultural crop introductions are held as living plant material at the four Federal introduction stations. These are clonal stock that cannot be held as seed. Each of the regional cooperative introduction gardens hold seed for current programs. The National Seed Storage Laboratory holds germ plasm in the form of seed on a long-time basis for future need, and also the hundreds (in some cases thousands) of accessions needed by various research groups in active plant improvement programs. Forest tree introductions are held as living plant material at the Federal Forest Genetics Institute at Placerville, California, and watershed cover material in southern California. (CR, FMR)	11.3.3 The new National Seed Storage Laboratory will provide adequate facilities for maintenance of germ plasm for several years. Land facilities for holding clonal stocks can be expanded. There is need to expand facilities and arboretums for preservation of non-seed (forest-tree) germ plasm. (CR, FMR)
11.3.4 Utilization investigations. Research is conducted to develop satisfactory processing procedures for new crops and to develop products from their major constituents that will make these crops attractive raw material sources for industry. (ENT, CR, FMR, EU, NU, SU, WU)	11.3.4 <i>Expand</i> research to determine potential industrial uses for products derived from new crops with special emphasis on crops that can be grown in place of crops now in surplus and giving due attention to the economics of processing and using the new crops. (ENT, CR, MD, EU, NU, SU, WU)
11.4 NEW TYPES OF ANIMALS	
Development of methods for evaluating meat qualities on the hoof. Research in the South on the development of beef and dairy cattle adapted to the special conditions in that region. Development of dairy cattle which produce milk with a higher solids-not-fat content in relation to fat, which utilize forage sources of feed, and which provide good beef without loss of milk yield. Studies to determine heritability, type of gene action, and other genetic attributes affecting the qualities of meat and wool. Development of meat-type hogs with less fat. Studies of methods and principles of breeding. Measurement and study of physical characteristics which may be used for developing an improved pollinating bee. (MQ, AH, ENT, FCS)	Expand physical and economic studies on the adaptability of livestock to geographic areas and to various forages. <i>Expand</i> research on the introduction, development, and evaluation of new breeding stock with needed qualities. Attention should be given to avoiding disease introduction. Explore the possibility of increasing the value of milking cows as meat sources. <i>Expand</i> research on methods of evaluating the meat and wool qualities of sheep on the hoof. <i>Expand</i> research to develop meat-type hogs and methods of determining the eating qualities of pork. <i>Expand</i> research on the feasibility of improving egg quality through breeding. <i>Expand</i> research on broiler and turkey production. Initiate research on developing ducks and geese as important sources of meat. <i>Expand</i> research to develop colonies of bees that have the physical structure necessary for pollinating purposes. (ADP, AH, MQ, ENT, FCS, FE)

OBJECTIVE 12.--To provide technical and economic guides for improved management and use of family and community resources, including those for health, education, housing, and such other goods and services as may be involved, and to study means of assisting people to achieve satisfying levels of living.

Higher levels of living result both from increased family and community resources and from better management of those resources in relation to goals. Programs to achieve better living must be based on research that permits understanding of existing levels and standards of living; that provides knowledge and skills to enable families to choose among alternatives the most profitable and satisfying use to be made of resources, to select goods and services wisely in relation to proposed use, and to employ improved methods for carrying on tasks that contribute to family living. In all areas of research on these subjects, studies should be designed to improve research techniques.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

12.1 LEVELS AND STANDARDS OF LIVING

(a) Collection and collation of data on family living including expenditures for living, quantities used of food, clothing, household equipment, furnishings, and other goods and services, and practices in the mode of their acquisition or in their use. (b) Appraisal of levels and standards of living of groups of families, classified by income, region, urbanization, family size, and composition. (c) Development of indexes of levels of living for communities or geographic areas. (d) Collection of data on financial status of farm families. (HHE, AEC, FI, FP, FE)

(a) Undertake large-scale surveys of rural family living every 10 years and (in coordination with U. S. Department of Labor) to provide simultaneous data for farm, rural nonfarm, and urban groups. Smaller community or regional surveys should be made in intervening years for analysis of special problems and for improvement of techniques. (b) Expand research to provide better bases for judging adequacy of diet, clothing, housing, and other goods and services, thus facilitating the appraisal of situations found. (c) Extend work to develop valid indicators or indexes of living levels attained as standards change, and for other groups as well as for farm families. (d) Expand work on financial status to include data by areas, and types of farm and family situation. (See also Objective 1.) (HHE, FI, FP, FE, AEC)

12.2 MANAGEMENT OF FAMILY RESOURCES

(a) Time and money management, developing principles and background data for use by families in decision-making relative to acquiring specific goods and services, and in overall budgeting, including provision for risk-protection and getting ahead financially. (b) Food management research, including development of quantity-budgets and simplified guides for diet planning at different cost levels, studies to define and help identify food quality, and improved methods of home food preparation, preservation, and care. (c) Clothing and household textile research providing principles for fabric evaluation, care, and use; inventories in relation to purchases of clothing and household textile articles, and study of time and money costs of home vs. commercial production and maintenance. (See also Objectives 1 and 10.) (HHE, HN, CH, FE)

(a) Expand research basic to long-range financial management taking into account family size, composition, and age of family. Expand research on management of time by the homemaker and other family members in relation to home production and purchase of goods and services, and to gainful employment outside the home. Expand research on factors contributing to prevention of fatigue in housework. (b) Keep food budgets up to date with scientific advances and economic change, and expand work on recognition of quality in food, methods of quality measurement, and improved methods for home preparation and preservation of food. Initiate research on budgets for clothing and household upkeep for use by social welfare agencies, and by families in their financial planning. (c) Expand work on quality recognition in clothing, household textiles, and equipment, and on improved procedures for care of modern fabrics.

(d) Initiate research on conservation of human resources on farms. (See also Objectives 1 and 10.) (HHE, HN, CH, FE)

12.3 HOUSING

(a) Research basic to the planning of livable and functional rural houses, including the determination of minimum structural requirements and desirable dimensions and arrangements of space, equipment utilities, and storage facilities. (b) Development of interior designs for farm-houses and working drawings. (c) Operating characteristics, performance requirements, and replacement rates for heating, refrigerating, and labor-saving equipment and for furnishings. (d) Requirements for environmental comfort (temperature, humidity, air movement). (e) Evaluation of materials for building and interior finishes, methods of installation, and protection against deterioration. (f) Cost-saving methods of construction both for farm-labor and for large-scale builders. (CH, AE, FPR)

(a)-(b) Expand and accelerate all phases of farm housing research, with emphasis on integrating segments of research on functional aspects into basic combinations of design for livable houses. Initiate a continuing program of evaluation of housing requirements of persons in different periods of the life cycle, e.g., the aging. (c) Expand research on farmstead electrical and water requirements and economical sewage disposal. (d)-(f) continue. (CH, AE, FPR, FE)

12.4 AVAILABILITY AND USE OF COMMUNITY OR PUBLIC RESOURCES

(a) Studies of health resources available, and characteristics of persons or families using, collation of information on organization, functions, and sponsorship of health-insurance carriers and enrollment data on health insurance. (b) Analyses of general and vocational educational facilities available and relation of type of education to migration and occupational adjustments. (c) Risk-protection, including annual estimates of farm fire losses; life insurance and annuities carried by farmers, use of life insurance and annuity principle in meeting family problems such as transfer of farm to heir; farm accident prevention and casualty insurance. (d) Studies of the impact of Social Security on farmers and farm workers. (e) Studies of short-term and farm mortgage credit involving determination of financial savings of farmers as reflected by debt reduction and assets such as bank accounts, savings bonds. (f) Rural zoning, benefits, zoning experiences and types of zoning districts and uses prohibited or permitted; effects of suburbanization on rural land use. (FP, FE, FER)

(a)-(f) Expand research to secure wider availability and wiser use of public services and community resources, including research on risk-protection and credit.

(g) Initiate research on recreational values and use of forest and other rural land. (FP, FE, FER)

OBJECTIVE 13.--To analyze the comparative advantages and disadvantages to farmers and to the Nation of alternative types of organization of farming so as to provide guides for improvement of the income of the farm family over the long term.

The major purpose of research under this objective is to determine the types of organization of farming that are likely to provide the best prospects for progress, income improvement, and stability under various conditions in different farming regions. This involves determining the most efficient sizes of farm and forestry business units, the most profitable systems of farming or forestry, and the advantages or disadvantages to farm people of combining in the same business unit production, purchasing of supplies, and marketing of farm and forest products. Because owner-operatorship of productive family farms is a major goal of farm people, special emphasis is needed on requirements for achieving this goal, including the capital needed to own, improve, and operate family farms, and the financial and other requirements for getting established in farming.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
13.1 SCALE OF FARMING AND FORESTRY OPERATIONS	
Cooperative study with Census on numbers, importance, and characteristics of major type-size classed by economic areas of the U. S. Study of trends in numbers, sizes, and tenure of farms and of income levels of farm and nonfarm families by major farming areas. Study of minimum resource requirements to provide specified level of income for dominant type of farm in a few areas, and of economy of size for such farms and areas. Area studies of tenure, financing methods, and use of farm labor. Studies of size and organization of timber production units, largely as part of general forest management investigations. Inventory of ownership by size of forest holdings. (FE, FER, FI)	Expand economy of size studies to all major farming and forest areas to determine most efficient size of units in different regions, considering technology, tenure, financial, and other conditions. The "farm woodlot" will be included as part of the farm business, but separate studies of scale are needed when forest products are the major enterprise. Determine the competitive position of efficient family-scale versus large-scale farms, with attention to influence of government programs on scale. Analyze potential effects of increasing size and decreasing number of farms. Analyze number of workers, incomes of farm people, and efficiency of production. Analyze changes that may be needed in credit, tenure, and other institutional factors to improve opportunities on family farms. Initiate research on problems of establishing and maintaining family-scale farms, taking advantage of improved technology, and determine sizes needed to provide specified incomes. (FE, FER, FI)
13.2 COMBINATION OF ENTERPRISES AND PRACTICES INTO EFFICIENT FARMING AND FORESTRY SYSTEMS	
Studies of desirable adjustments in farming in several areas in view of changes in technology and price-cost relationships. Measures of current changes in organization, income, and costs of 36 major types of farms. Soil and water studies of "best combinations" of soil, water, and crop practices on plot, field, and farm unit bases, including three "farm trial" research farms. Engineering studies of efficient farmstead design and operation. Studies of new farming systems and nonfarm employment in low income areas. Studies of economics of forestry and alternative land uses, and appraisal of relative returns from timber, livestock, and crops. (FE, SWC, AE, FER)	Expand adjustment and contributing studies to complete and keep up to date the guidance needed for establishment of efficient farming and forestry systems in farm and forest areas with broadly similar production opportunities, including adjustment studies in about 100 farming areas and expansion of costs and returns studies to provide measures of current changes in production, income, and costs, by type and economic class of farm in the same areas. Strengthen research on "combinations of practices" and determine physical inputs and costs of these combinations, including both crops and livestock and the engineering and economic aspects of these combinations. Initiate more farm trial research to appraise combinations of enterprises and practices in farm operating units. Expand research on cost of establishing, growing, and utilizing timber on various sites and forest types. (AE, FER, FE, SWC)
13.3 ADVANTAGES AND DISADVANTAGES OF COMBINING PRODUCTION, PURCHASING SUPPLIES, AND MARKETING OF PRODUCTS IN THE SAME BUSINESS UNIT (VERTICAL INTEGRATION)	
A pioneering research unit studies interfirm integration in farming. Studies are conducted of financial, efficiency and tenure aspects of vertical integration. Studies are conducted to analyze combination of marketing and purchase of supplies, but not in combination with production. (FE, FCS)	Initiate studies by major commodities and areas of the effects on efficiency and income in farming and forestry units, of combining purchasing of supplies and marketing with production in the same business unit. Analyze effects on competitive position of family farms of such combinations. Analyze effects of contracts with farmers for production and delivery of specified products, and of different types of custom supply services. Explore alternative ways of securing needed combination of functions, including greater emphasis on cooperatives. Give special attention to these problems in broiler, egg, hog, vegetable, and other areas where such combinations have expanded in recent years. (FE, FER, FCS, ME)

(See page 13 for key to agency symbols)

OBJECTIVE 14.--To appraise the various forms of organization and operation of markets for farm and forest products, and of policies and practices in the conduct of trade in such markets, including farmers' marketing, purchasing, and service cooperatives; and, if possible, to develop improved methods of organization and operation.

Realization of the benefits of specialized farm and forest production in supplying our large and growing population with food, fiber and forest products and in developing foreign trade depends upon an increasingly intricate and far-flung organization of markets.¹ Trade in these markets determines the current allocation of supplies and establishes the prices that farmers receive and that consumers pay and that we depend upon to guide future production. Market growth and technological change create both problems of adjustment and opportunities for improvement in market organization and trading practices. Research in this area is in great need of broader and more systematic development to build up fundamental knowledge that can be drawn upon for overcoming current problems and anticipating future needs.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

14.1 BUYING AND SELLING PRACTICES

Analyses of procurement practices of processors and distributors, and their effects on prices received by producers for particular commodities. Problems of market organization and structure and needed adjustments in the marketing of particular commodities by producers.

(ME, FER)

Expand to include more commodities and types of markets, with emphasis on building up systematic knowledge of alternative practices appropriate to different marketing situations, their consequences, and criteria of needs for their modification with changing conditions. Expand studies to determine the information needed, and its adequacy, as a basis for buying and selling decisions. Study the effects of buying policies on market structure and use of products, particularly in the development of controls over the supply of a commodity or practices of skimming the best grades from the market and leaving larger supplies of lower grades.

(ME, FER)

14.2 PRICES AND PRICING

Studies of formula pricing, price bargaining associations, retail pricing, seasonal aspects of pricing, and methods for reflecting quality differences. Descriptive studies on pricing practices and organization for particular commodities.

(ME, FCS, FER)

Expand research in this area with emphasis on basic analysis of factors underlying price determination, pricing methods, and pricing policies, and functional appraisal of pricing under various forms of market organization. Special problems requiring greater study include pricing to reflect quality differences in products, geographic and seasonal price relationships, monopolistic and manipulative pricing, problems arising from the continuing decentralization of markets and consequent loss of centers for price determination, and growth of "administered" versus "market" pricing; the influence of price risk in the accumulation of commodities and its effects on the allocation of supply; the influence of contract farming and other forms of integration on farm prices.

(ME, FCS, FER)

14.3 INSTITUTIONS AND MANAGEMENT PRACTICES

Studies, largely related to particular immediate problems, of the place of special institutions and management practices in the marketing system. Studies on future markets, Government regulations and services, effects of labor-employment practices, financing of cooperatives.

(ME, FCS)

Expand to emphasize basic functions of the institutions in the market place; the effects of management practices upon market organization; the role of government -- Federal, State, and local -- in the marketing picture, including effects of governmental participation on organizational forms and practices and the need for greater or less participation in various phases of marketing.

(ME, FCS, FER)

14.4 EFFICIENT PERFORMANCE OF MARKETING FUNCTIONS

Analyses of costs and efficiency of particular commodity marketing operations or functions, and relation of costs to marketing margins for commodities. Conducting studies and developing plans for improved marketing facilities. (See also Objectives 5 and 9.)

(ME, TF, FCS, FER)

Expand research to develop over-all measures of efficiency of performance of marketing functions as affected by market organization and trading practices, and to appraise adjustment of marketing channels to changing production, processing, and consumption patterns. (Needs relative to efficiency of specific operations are considered under Objective 9; relative to facilities, under Objective 5.)

(ME, TF, FCS, FER)

14.5 ECONOMIC CONSEQUENCES OF SCALE OF OPERATION

Analyses of economics of scale for particular commodity marketing operations, and of adjustments of scale to changing conditions of production and marketing. (See also Objective 9.)

(ME, FCS, FER)

Expand to include more types of operations and additional commodities with continuing emphasis upon problems arising from technological innovations or other new developments, and with increased emphasis upon effects on industry organization and market structure. (See also Objective 9.)

(ME, FCS, FER)

14.6 INTEGRATION, VERTICAL AND HORIZONTAL

Studies of problems created by mergers or other consolidations of marketing operations under single ownership or management or consolidation of control through contractual or financing arrangements. Examples are: Control of successive operations, such as farm production or assembly, processing, and distribution (vertical integration); or control of similar operations at different locations, such as multiple processing plants or chain distributive outlets (horizontal integration); or control involving both vertical and horizontal integration.

(ME, FCS, FER)

Expand research to determine how growth of economic power through mergers and "bigness" in operations dealing with farm and forest products, affect the farmer, timber grower, handler, processor, and consumer.

(ME, FCS, FER)

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
14.7 LOCATION OF MARKETING ACTIVITIES	Emphasize studies on economics of location as related to patterns of production and consumption, transportation costs, and the structure and organization of markets. (See also Objective 9.) (ME, TF, FCS, AEC, FER, FE)
14.8 FOREIGN MARKETS AND MARKETING	Expand research in this area to provide more fundamental analysis of the organization and structure of foreign markets, and of export trade in this country, as the basis both for facilitating commercial operations in foreign market development and for development and appraisal of Government trade policies and programs. (FAS, AEC, FCS)
14.9 PROCUREMENT OF FARM SUPPLIES AND SERVICES	Expand the present program with emphasis upon policies and practices in the purchasing of farm supplies and services. (FCS, FE)
14.10 PRESENT AND FUTURE EFFECTS OF NEW TECHNOLOGY AND OTHER PROSPECTIVE DEVELOPMENTS	Expand to permit a systematic approach to anticipating future developments and their likely impact upon production, consumption, and market organization. Examples of items needing evaluation are the impact on the structure of markets of applications of irradiation in storing, processing, and marketing agricultural products; of the health aspects of the use of tobacco in various forms; of the use of "homogenized" tobacco leaf; of the development of a readily reconstituted, stable whole milk powder; of guaranteed annual wages and similar plans; of expanding use of consumer credit. (ME, TF, MD, FER)

(See page 13 for key to agency symbols)

OBJECTIVE 15.—To provide comprehensive and reliable statistics on matters basic to agriculture, including statistics on production, prices, farm income, utilization, consumption, and trade.

The Department regularly publishes a variety of statistics which are widely used by farmers, businessmen, educators, research workers, administrators, and legislators. The Department also uses statistical methods of analysis in much of its research. Continuous effort is directed to improvement of accuracy, comprehensiveness, and timeliness.

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

15.1 STATISTICAL INFORMATION

Among the many areas of statistics published regularly by the Department are acreage, yield, production, and value of crops, numbers, production and value of livestock, total farm output, prices received and paid by farmers, farm income, stocks, utilization, and consumption of agricultural commodities, farm population and employment, farm debt, real-estate values, foreign trade, and statistics concerning agricultural programs of the Department.

(AES is the principal source of regularly published statistics, but practically every research division and action agency also has need to publish statistical information.)

(a) Possible curtailment: Study of accuracy of early-season forecasts and preliminary estimates of crop acreage and production with a view to eliminating reports of doubtful value. (AES, AEC)

(b) Better coordination of data: Poultry production and slaughter; production and marketing of eggs; farm employment; stocks of grain and other field crops; cold-storage stocks; supply and distribution of wool; production and consumption of fats and oils; international supply, utilization, and carryover; Government export programs; domestic food programs. (AES, FP, FAS, CSS, CCC, and non-Federal agencies)

(c) Improvements in quality of statistics: Prices received by farmers; prices paid by farmers; farm income, costs and returns; production of fruit and vegetables; land use; inputs and productivity; regional estimates of farm population; farm employment and wage rates; farmer cooperatives; mortgage loans, and debt; balance sheet of agriculture; value of real estate; cold storage; truck movement of fruits and vegetables; food production and stocks; foreign trade; preliminary estimates of exports; foreign agricultural developments; forest-product statistics; forest resources. (AES, AEC, FE, FCS, FP, FAS, FER)

(d) Filling gaps in statistics: Farm income by type and economic class of farm; number of farms by type and class; farmers' participation in cooperatives; pasture acreage and production by States and type of pasture; range acreage and production; production of grass silages; irrigated and non-irrigated land; summer fallow; water-use inventory; more frequent reports on livestock and poultry production and prices; production of sesame, safflower, castorbeans; more frequent data on production and stocks of dry beans and peas; fertilizer utilization; feed utilization; financial condition of major groups of farmers by areas; conservation programs; available storage capacity; number and types of trucks hauling agricultural products; production and utilization of cooking and salad oils; utilization of miscellaneous foods (e.g. potato chips); utilization of byproducts and residues (e.g. corn cobs); synthetic or derived materials used in foods and feeds; prices and quantities by quality grades; sales of cigarettes by type; inventories, military takings, prices and qualities of cotton, wool, and textile products; needs for national emergencies; labor costs and productivity in processing and marketing; periodic surveys of family consumption of foods and of other goods and services; food consumption in institutions and restaurants; surveys of individual diets; intensive study of food marketing and consumption in one community. (AEC, FE, AES, ME, FER, FCS, HHE, MD)

(e) Possible improvements requiring further study: Annual enumerative sample survey of agriculture; systematic objective measurements of sample fields for yields per acre by States; national panel of farmers; national consumer panel; research on quotations and actual prices in terminal markets; techniques of obtaining data on consumption and savings. (AES, MD, AEC, HHE, FE)

15.2 STATISTICAL THEORY

Limited studies on sampling, design of experiments, and structural analysis. (All research divisions)

Expand basic research on mathematical statistics and statistical method as an integral, necessary part of the agricultural research program. (All research divisions)

15.3 APPLIED RESEARCH ON STATISTICAL METHODS

Preparation of handbooks and manuals and provision for training and consultation. (All research divisions)

Expand substantially to meet the needs of research workers and make most effective use of new and improved statistical methods. (All research divisions)

(See page 13 for key to agency symbols)

OBJECTIVE 16.—To determine the effects of broad agricultural policies and programs, and explore alternative policies and programs, designed to improve the income of farm people and strengthen both agriculture and the economy as a whole; to determine the interrelationships and to further mutual understanding of interdependence between agriculture and other segments of the economy.

An organized effort is needed to enable research divisions and action agencies to work together in continuously reviewing and analyzing the effects of agricultural programs. Present effort is scattered and sporadic and lacks adequate advance planning and coordination.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
16.1 PRICE AND INCOME PARITY AND SUPPORTS Statistical measures of parity prices, per capita incomes of farmers, and similar guides to programs supplemented by occasional special studies by temporary task forces. (AES, AEC, FE)	Expand greatly, providing for continuous study of effects of present programs and of probable effects of alternative programs. Initiate work on income from forest products. (AES, AEC, FE, FER)
16.2 PRODUCTION ADJUSTMENTS Limited studies of the Conservation Reserve Program and a few local studies of the effects of other production adjustment programs. (FE, AEC)	Expand to include a series of continuing studies in all major farming areas to develop current information, to evaluate alternative programs, and to measure regional and national effectiveness of programs. See also Objectives 3, 4, and 13. (FE, AEC, FER, in cooperation with CSS, ACPS, SCS, and the State Agricultural Experiment Stations)
16.3 INCREASING DOMESTIC CONSUMPTION Day-to-day evaluation of such programs as plentiful foods, school lunches, school milk and direct distribution. (FD, MD, HHE)	Expand research on present and alternative programs. Emphasize both nutritional needs and effectiveness in moving surpluses. See also Objectives 1 and 11. (FD, MD, HHE)
16.4 SURPLUS REMOVAL	Initiate research on effects of surplus-removal programs on growers' incomes and on total consumption of foods. See also Objective 11. (MD, AEC, FD)
16.5 INCREASING EXPORTS Special studies of aspects of programs under P.L. 480, Section 32, World Wheat Agreement, and other authorities. (FAS and CSS, in cooperation with research agencies)	Expand to evaluate economic significance of programs. See also Objective 11. (FAS and CSS, in cooperation with research agencies)
16.6 SOIL AND WATER CONSERVATION Technical studies, costs and returns, production capacity, and economic evaluation of land and water programs. (SWC, AE, FE, FER, WMR)	Expand research to overcome barriers to adoption of desirable conservation programs. See also Objective 6. (SWC, AE, FE, FER, WMR)
16.7 FOREST CONSERVATION Surveys of forest resources and periodic appraisal of timber supplies and requirements. Studies of forest recreation needs. Technical studies in forest resource protection and management and economic evaluation of forestry programs. (FER, FMR, RMR, WMR, FFR, FIR, FDR)	Expand with emphasis on improving estimates of current and potential forest productivity, price trends and long-term estimates of forest-products requirements, costs and returns of growing timber, multiple-use aspects of national-forest use, and the non-monetary and indirect effects of programs. See also Objective 6. (FER, FMR, RMR, WMR, FFR, FIR, FDR)
16.8 OTHER PROGRAMS	
16.8.1 <u>Rural electrification</u>	16.8.1 Expand technical research. Initiate studies of effects of rates on use of electricity. (AEC, FE, in cooperation with the appropriate action agency)
16.8.2 <u>Federal crop insurance</u>	16.8.2 Initiate research on crop insurance and other methods of reducing risks and stabilizing incomes. (AEC, FE, in cooperation with the appropriate action agency)
16.8.3 <u>Enforcement of regulatory acts</u>	16.8.3 Initiate research on economic effects of such regulations as plant and animal quarantines, commodity-exchange trading, Packer's and Stockyards Act, milk marketing, and meat inspection. (AEC, FE, in cooperation with the appropriate action agency)
16.8.4 <u>Marketing agreements and orders</u>	16.8.4 Expand, with emphasis on long-run effects of orders on dairy products, fruits, and vegetables. (AEC in cooperation with the appropriate action agency)
16.8.5 <u>Market news</u>	16.8.5 Expand research on reporting truck movements, methods of disseminating information, sampling, and accuracy of reports. Expand programs to provide information of interest to consumers. (AEC in cooperation with the appropriate action agency)

(See page 13 for key to agency symbols)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

16.8 OTHER PROGRAMS (Continued)

16.8.6 Grades, standards, inspection

16.8.6 Expand research on consumer and market preferences, methods of quality evaluation, and sampling. See also Objectives 1 and 10.
(AEC in cooperation with the appropriate action agency)

16.8.7 Outlook

16.8.7 See Objective 3.

16.8.8 Farm credit

16.8.8 See Objectives 3, 4, and 13.
(AEC, FE, AF, ME, ENT, MD, MQ, HHE, in cooperation with the appropriate action agency.)

16.8.9 Farmer cooperatives

16.8.9 Expand research on economic contributions of farmer cooperatives.
(FCS)

16.9 INTERRELATIONS BETWEEN AGRICULTURE AND REST OF ECONOMY

(AEC)

Expand, to develop basic relationships between agriculture and the rest of the economy, including the effects of general economic policies upon farmers and the effects of agricultural policies upon non-farmers.
(AEC, FE, FER)

(See page 13 for key to agency symbols)

The Department's wheat research program is analyzed in this summary with indication of the nature and scope of the present program and the changes needed to balance and strengthen it. All of the recommended changes stated here will be implemented if the changes recommended under Objectives 1 through 16 are effected.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
17.1 DEMAND, REQUIREMENTS, AND SUPPLY	
17.1.1 Supplies and requirements. Research and release of periodic reports on the quantitative and qualitative requirements in the United States and for export. Research to analyze the obstacles toward achieving a balance between supply and demand. Study of U. S. needs for reserve stocks. (AEC, FAS, CSS, FE)	17.1.1.1 Expand research to determine the quantity of the various classes of wheat used for food and feed in the United States and on price relationships of the classes. Expand research on quality characteristics required by domestic and foreign purchasers and processors. (AEC, FAS, CSS, FE)
17.1.2 Price analysis. Comprehensive study of the demand and price structure for wheat. (AEC, FAS)	17.1.2.1 Emphasize analysis of price movements and price-making forces. (AEC, FAS)
17.1.3 Food consumption and dietary levels. Studies of trends in different parts of the country in changing consumption patterns for wheat products in relation to consumption of other foods. Research to determine the nutritional values contributed by wheat and wheat-derived food products. Consumer-preference surveys for different pan breads and other wheat food products. (HHE, NU, WU, AEC, MD, AES)	17.1.3.1 More data are needed on consumption of wheat and wheat products by various consuming units, on seasonality of uses, and on nutritive values and potential diet contribution in relation to human health. Analysis of survey results should be intensified and accelerated. (HHE, NU, WU, AEC, MD, AES)
17.2 PRODUCTION	
17.2.1 Plant management. Research on seed stocks, physiology, rotations and cultural practices for wheat. Seed stock research consists of breeding and evaluating new and improved varieties of all types; explorations to acquire useful germ plasm; genetic studies on transmission of characters; technological studies to improve breeding procedures or to improve production practices; studies to evaluate the quality of potential new varieties; research to determine the basic nature of and best means of testing for quality characteristics sought; research on the basic responses of wheat to photoperiod and quality of light. Research on crop rotations and cultural practices. Limited research on grass tetany. (CR, ENT, WU, NU, AH, SWC)	17.2.1.1 Expand basic research on the problems associated with winter killing; drought; injury from low and high temperature; frost damage; relation of variety adaptation to soil acidity; soil salinity; different fertilizers; the effects of climate on development of crop plants and their relation to insects, diseases, and herbicidal action; the effect of such factors on the quality of the crop. Increased efforts to provide new germ plasm and on its preservation. Expand basic genetic and cytology studies. Intensify studies to develop better machinery to establish stands of proper density under drought conditions. Expand research on basic aspects of grass tetany. Expand research to develop new crops to use in the Western and Plains wheat areas on acres diverted from wheat. (CR, ENT, WU, NU, AH, SWC)
17.2.2 Soil and water management. Research on fertilizer use as related to soil fertility level and moisture supply for wheat cropping systems. Studies on moisture conservation and wind and water erosion control in wheat-growing areas. Research on the irrigation and drainage requirements for cropping systems involving wheat. Investigations in special stations established to deal with problems in particular drainage districts. (SWC, AE, FE, CR)	17.2.2.1 Expand research on the effect of residue management on yield, soil properties, nutrients, erosion control, and efficient use of all available moisture. Expand basic research on effects of soil structure on crop yields. Specific information is needed on terrace grade, spacing, costs, water conservation benefits, and methods of maintenance. Expand work on soil compaction and tillage operations required for optimum erosion control and production of wheat on both irrigated and nonirrigated areas. Additional crop-sequence investigations are needed and the effects of fertilization in various cropping systems should be studied. (SWC, AE, FE)
17.2.3 Pest control. Research on diseases includes studies on smut, blackstem rust, virus diseases, foot rot, nematodes, and mildew and involves treatment of seed and soil, breeding for resistance, importation of disease-resistant varieties; analysis of chemical and physical properties of pathogens (especially viruses), vectors of disease, and chemical and biological precautions in the control of disease. Research on insects includes work on Hessian fly, wheat joint worms, wheat stem sawfly, greenbug, thrips, aphids, mites, cutworms, army worms, and grasshoppers and involved breeding for resistance to insects, biology and ecology of insects, development of biological, ecological, and chemical controls, identification and classification, and importations of natural enemies. Research on weeds includes evaluation and development of new herbicides, effect of tillage and cropping systems on weed control, physiological mechanisms of herbicidal action, ecology of weeds as related to control, influence of herbicides on crop plants, and residue determinations. (ENT, CR, NU, SWC, MQ)	17.2.3.1 Expand basic research on rusts and other diseases with emphasis on epidemiology, genetics of pathogenicity and of resistance, physiology of pathogenicity and resistance, cytology, chemical control, and physiologic specialization. Scab, septoria, viruses, root rots, leaf spots, various physiological disorders, and nematode infestations should be studied. Expand all phases of research on beneficial insects, insect pathogens, and other associated organisms; factors influencing insect population dynamics; role of insects in transmission of diseases; pesticide residues on or in wheat and in the soil; nature of resistance of plants to insects. Expand weed research on development of more selective herbicides; on the effect of herbicides on wheat composition; on the development of a less volatile herbicide for wheat to avoid injury to susceptible crops in adjacent areas. (ENT, CR, NU, SWC, MQ)
17.2.4 Economic and management problems. Research includes economic studies on farm costs and returns, efficiency of production, soil and water conservation practices and appraisal of conservation systems, evaluation of alternative crops and development of farming systems with less emphasis on wheat and with needed adjustments in production. (FE, CR, SWC, ENT)	17.2.4.1 Expand research on adjusting farming to less wheat, including analysis of alternative farm programs, ownership problems and operating patterns and special problems on small farms. Expand studies on organizing and operating farms in localities having highly variable weather; on effects of weather on management and costs; on flexible crop and livestock systems; on kinds and amounts of reserves; on the contribution of crop insurance to income stability. (FE, CR, SWC, ENT)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

17.3 PROCESSING AND UTILIZATION

17.3.1 Composition, nutritive value, structure, chemical and physical properties. Studies are primarily basic, some methodological, on wheat or on primary or secondary end-use products. Studies are aimed at establishing the value of a substance or product, or to obtain data required in other processing and utilization research.
(CR, NU, WU, AH, HHE, HN)

17.3.2 Milling, processing, and conversion methods. Applied research with emphasis on flour quality and on exploring the several types of conversion that are used to produce wheat fractions having promising use possibilities.
(CR, NU, WU)

17.3.3 New and improved end-use products. Research of a developmental, evaluational, demonstration (pilot-plant) nature, including work on the chemical and/or physical modification of wheat and its fractions and on packaging of products.
(NU, WU, MQ)

17.4 MARKETING

17.4.1 Market margins and costs. Current work is limited to costs of warehousing and handling, and to studies to relate the share of the price to consumers that goes to each of the principal marketing functions.
(ME, TF, FCS)

17.4.2 Market organization and marketing practices. Studies concern the effects of market organization, public regulations, pricing practices, methods of financing, type of ownership, and new product form on returns to producers.
(ME, TF, FCS)

17.4.3 Physical market facilities. Research to determine the adequacy of physical facilities for assembling, warehousing, transporting, processing, and retailing.
(MQ, TF, ME, FCS)

17.4.4 Evaluation and measurement of market quality. Research to identify and measure product quality characteristics of importance to processors and consumers, both domestic and foreign, of wheat and wheat products. Research on protective packaging and sanitation problems associated with marketing process.
(MD, MQ, CR, FCS, FAS)

17.4.5 Storing and conditioning wheat. Research relates to both farm and off-farm storage and covers the development and improvement of storage structures, equipment and methods of handling, drying, aerating, and fumigating. Major emphasis is given to the control of moisture, temperature, and insects. Methods and materials are being developed and appraised to protect wheat from infestation as well as to control infestation after it occurs.
(AE, TF, MQ, ME, AEC, FCS, CCC)

17.3.1 Expand research to identify and measure the inherent nutritive or other values of wheat and its products and the interrelationships with other nutrients that make them useful in satisfying human needs as food, feed, and industrial products, and to develop guides for selecting and using these products effectively. Basic research to improve quality through plant and soil management should be increased.
(CR, NU, WU, AH, HHE, HN)

17.3.2 Expand research to identify the properties responsible for quality in wheat and its products and to maintain or enhance these properties through improved processing.
(CR, NU, WU)

17.3.3 Expand chemical research to develop new products from wheat, with emphasis on industrial products, in order to provide profitable, expanded markets for this crop. Initiate research to provide comprehensive and reliable economic and market data on matters basic to wheat processing and utilization.
(NU, WU, MQ)

17.4.1 More intensive study of detailed cost data for firms marketing wheat products is needed to show where savings may be made and efficiency increased.
(ME, TF, FCS)

17.4.2 Expand research to determine the relationship of the market structure to the efficiency with which marketing functions are performed.
(ME, TF, FCS)

17.4.3 Expand to determine changes needed to meet changing conditions in the marketing system.
(MQ, TF, ME, FCS)

17.4.4 Expand studies to provide a basis for supplying wheat products in forms wanted by both domestic and foreign buyers; to consider the relationship of quality to processing efficiency and cost; to develop more reliable, rapid, and simple methods for measuring quality.
(MD, MQ, CR, FCS, FAS)

17.4.5 Emphasize research on ways of storing wheat over periods longer than one or two years; on the development of more effective and less costly means for control of insects and rodents; on the basic relationship between moisture and temperature to improve drying and aeration techniques. Economics of storage and Government storage policy should be studied.
(AE, TF, MQ, ME, AEC, FCS, CCC)

(See page 13 for key to agency symbols)

COTTON

The Department's cotton research program is analyzed in this summary with indication of the nature and scope of the present program and the changes needed to balance and strengthen it. All of the recommended changes stated here will be fully implemented if the changes recommended under Objectives 1 through 16 are effected.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
18.1 MAINTAINING AND IMPROVING QUALITY OF RAW FIBER AND END PRODUCTS. Research in this area seeks to provide raw cotton fiber and cotton textile products with higher quality and greater versatility to meet and create consumer demands.	
18.1.1 <u>Production and ginning.</u> Breeding research to develop basic information on wild, primitive, and cultivated species and varieties of cotton, and to determine how these sources of germplasm may be used to modify heritable fiber characteristics. Research to devise practical methods for controlling cotton insects, diseases, and other sources of deterioration during the growth of the cotton plant. Studies of soil-moisture relationships, mechanical and chemical weed control, defoliation, and mechanical harvesting. Research on improvement of ginning techniques and the development of adequate covering for bales of cotton to maintain inherent fiber quality. (AE, ENT, CR, SWC)	18.1.1 Expand research on quality improvement through increased attention to breeding and disease, insect and weed control. Expand research designed to obtain cotton lint of unimpaired quality by developing better harvesting, drying, cleaning, ginning, and packaging practices. (AE, MQ, ENT, CR, ME, SU)
18.1.2 <u>Mechanical and chemical processing.</u> Mechanical processing research to utilize the inherent properties of the raw fiber to improve processing performance and to improve the quality of cotton textile products. Research to develop more versatile cotton products by means of chemical treatments and resin applications. (SU)	18.1.2 Expand research to develop new mechanical and chemical processing equipment and techniques which will improve processing performance and give maximum product uniformity and other quality factors. Expand chemical processing studies aimed at imparting new and improved properties to cotton products, such as wrinkle resistance, water repellency, and rot-, weather-, heat-, and flame-resistance. (SU)
18.1.3 <u>Fiber properties and structure.</u> Research to determine and evaluate fiber properties and structure as an aid to the selection of new strains of cotton and to the improvement of processing performance. The evaluation from a quality standpoint of different practices in connection with production, harvesting, ginning, marketing, and mill utilization of cotton. The selection of proper cottons for the development of quality products. (AE, MQ, CR, SU)	18.1.3 Expand research to detect and determine the importance of particular properties of cotton fibers to processing performance and to the value of major end products. Expand research to develop more rapid, accurate and, where possible, automatic instruments and methods of measuring fiber properties. (AE, MQ, CR, SU)
18.1.4 <u>Marketing and utilization practices.</u> Research to develop better handling procedures; to improve uniformity of price-quality relationships at local, central, and mill markets; to determine effects of raw cotton qualities on commercial end-product qualities; to determine effect of fabric construction on serviceability and care of consumer goods. (MQ, CH, MD, ME, SU)	18.1.4 Expand studies of the quantities and qualities of cotton produced by domestic mills, of the qualities of raw cotton most suitable for various end products, and of the qualities that consumers want in various end products. (MQ, CH, MD, ME, SU)
18.2 INCREASING EFFICIENCY OF PRODUCTION, PROCESSING, AND MARKETING. Research in this area is directed toward increasing efficiency by reducing unit costs of producing, processing, and marketing cotton and cotton products, and toward the adjustment of production and market demands. Results of this research will tend to provide a basis for improving cotton's competitive position through lowering both the mill price for raw cotton and the price paid by the consumer for cotton products.	
18.2.1 <u>Production and ginning.</u> Breeding research to develop varieties combining higher yielding potentials with resistance to diseases and insects, and with characteristics better adapted to harvesting practices and environmental conditions. Cultural practices and mechanization research to increase production efficiency. Production economics research to determine the conditions under which new production techniques will pay and to appraise the effects of their adoption on the cost of producing cotton. Determination of the most profitable combinations of resources and enterprises on cotton farms. Ginning research to develop equipment and methods for ginning cotton more efficiently while maintaining grade and quality. (AE, MQ, ENT, CR, FE, AEC, SWC)	18.2.1 Expand research to develop higher yielding varieties adapted to mechanical culture and harvesting; on chemical and mechanical methods of controlling weeds, insects, and diseases; on mechanical harvesting, supplemental irrigation, and fertilization. Expand economic evaluations of combinations of resources and enterprises on cotton farms and efficiency of production and harvesting practices. Initiate composite regional and national evaluations of changes in production, markets and production efficiency from one year or period to another under selected production situations. Expand research to improve the efficiency of ginning, packaging, and sampling and handling practices. (AE, MQ, ENT, CR, FCS, ME, FE, SU, TF)
18.2.2 <u>Mechanical and chemical processing.</u> Mechanical and chemical processing research to increase the efficiency of processing cotton fibers into textile products through development of new and improved processing equipment and determination of the processing operations required to handle the cotton with maximum efficiency and lowest product cost. (SU)	18.2.2 Expand research to develop new and improved mechanical processing equipment and procedures, and to develop new and improved equipment and procedures for the chemical processing, finishing, and modification of cotton fiber, yarn, and fabrics. (SU)

(See page 13 for key to agency symbols)

COTTON (Continued)

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
18.2 INCREASING EFFICIENCY OF PRODUCTION, PROCESSING, AND MARKETING (Continued)	
18.2.3 <u>Fiber properties.</u> Research to evaluate the influence of fiber properties on the efficiency of processing as measured by amount of waste, number of ends down, nep formation, and finishing performance. (AE, MQ, CR, SU)	18.2.3 Expand research on the identification of the inherent qualities and characteristics of cotton fibers as a basis for improvement in present methods of grading and classifying cotton lint. Expand the development, evaluation, coordination and standardization of equipment and methods for determining cotton qualities as they affect the efficiency and costs of commercial utilization and marketing operations. (AE, MQ, CR, SU)
18.2.4 Marketing and utilization practices. Research to determine the efficiencies and costs of procedures involved in taking lint cotton from the gins through the various marketing and processing operations and to the delivery of the finished cotton products to the ultimate consumers. (FCS, MD, ME, TF)	18.2.4 Expand studies of the efficiencies and costs of handling, storing, transporting, merchandising, manufacturing, fabricating, and distributing cotton and cotton products, and of the effects of Government programs on the efficiency of cotton processing and marketing. (MQ, FCS, MD, ME, AEC, TF)
18.3 PRODUCT AND MARKET DEVELOPMENT	
18.3.1 <u>Influence of fiber properties and structure.</u> Research to determine the microscopic and submicroscopic structure of cotton fibers and the mechanisms by which chemical treatments affect improvements in cotton products. (CR, SU)	18.3.1 More basic information is needed to provide a basis for the selection of classes of chemical treatments that will impart desired properties to cotton products. (CR, SU)
18.3.2 <u>Chemical and mechanical processing.</u> Chemical and mechanical processing research to develop new products for specific end uses. (SU)	18.3.2 Emphasis should be given the following areas of research: development of radically new methods and equipment for the production of desirable cotton products at attractive prices; investigations of chemical reactions of cotton cellulose as a means of producing new products for specific end uses. (SU)
18.3.3 <u>Consumption needs.</u> Annual per capita disappearance of cotton for domestic consumption and export. Studies to determine consumer satisfactions and complaints in order to reveal needs for technological improvement in cotton textiles and for more aggressive promotion and merchandising. Studies of the properties, including serviceability in household use, of cotton fabrics of different types for various end uses. (MD, CH, HHE, AEC)	18.3.3 Additional studies are needed to indicate properties wanted for specific end uses that appear to be promising from the standpoint of expanding the market outlets for cotton. More information is needed on household inventories and consumer preferences and practices in buying, on trends in consumption and market potentials for cotton, and on the effects of domestic and foreign educational, promotional and governmental programs on the market outlets for cotton. (MD, CH, HHE, AEC, SU, FAS)
18.4 BALANCING THE SUPPLY AND DEMAND FOR COTTON	
18.4.1 <u>Cotton prices and supplies.</u> Research to analyze the interrelationships among spot prices in different markets and for different qualities of cotton, and to determine the adequacy and reliability of central market prices for various qualities of cotton as quoted by the spot cotton exchanges. (ME, AEC)	18.4.1 Expand studies of the factors affecting the domestic supply and the average price of American cotton. These studies should include farmers' responses to changes in production costs and production technology. (CCC, CSS, ME, AEC)
18.4.2 <u>Domestic and foreign demand for cotton.</u> Studies to determine the effects of certain factors, such as competition and variations in price and stocks, on the foreign and domestic demand for cotton. (FAS, ME, AEC)	18.4.2 Expand analyses of factors affecting or determining the domestic and the foreign demand for cotton. (CCC, CSS, FAS, MD, ME, AEC)
18.4.3 <u>Government programs.</u> Analyses to appraise the effects of export programs, acreage allotments, marketing quotas, and price support programs. (FE, AEC)	18.4.3 Expand studies of the effects of price support, acreage adjustment, and surplus disposal programs, including studies of alternative programs and policies. (CCC, CSS, FAS, FE, AEC)

(See page 13 for key to agency symbols)

VEGETABLE FATS AND OILS

The Department's fats and oils research program is analyzed in this summary with indication of the nature and scope of the present program and the changes needed to balance and strengthen it. All of the recommended changes stated here will be fully implemented if the changes recommended under Objectives 1 through 16 are effected.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
19.1 PRODUCTION RESEARCH. Breeding, pathological, entomological, engineering and cultural studies are conducted to increase efficiency of production, improve quality, improve plant nutrition, and reduce production hazards, including improvement of foundation seed stocks, weed control, and curing practices on peanuts, soybeans, flaxseed, tung, castor beans, safflower and sesame. Other studies on these specific crops are:	
19.1.1 <u>Peanuts</u> . Development of equipment and facilities for efficient production, harvesting, and on-farm storage. Studies of adjustments in farming to meet changing market demands, price and cost relationships and income. Identification and control of insect pests. Evaluation of meal and fat as food and as feed for livestock and poultry. (CR, AE, FE, ENT, HN, AH)	19.1.1 Expand: curing studies on Virginia-type peanuts including effect of rapid curing on quality; cultural practices including weed, disease and insect control; basic research on physiology, genetics and mineral nutrition; mechanical and chemical quality measurement methods; harvesting and storage research on Virginia-type peanuts. An economic evaluation of the production of peanuts, strictly as an oil crop, is needed. (HE, AE, FE, ENT, HN, AH)
19.1.2 <u>Soybeans</u> . Development of equipment and facilities for efficient production harvesting and on-farm storage. Studies of adjustments in farming to meet changing market demands, price and cost relationships and income. Identification and control of insect pests. (CR, AE, FCS, FE, ENT)	19.1.2 Shift breeding emphasis to higher protein, lower oil beans if prior economic analysis of possible effects on farmers and the industry of such a shift is favorable. Expand studies on chemical weed control; basic physiology; genetics; diseases that reduce qualities needed in export trade, particularly in the South; needed adjustments in major soybean production areas to meet changing market demands for soybeans; control of insects by chemicals, parasites and resistant varieties; power and labor-saving production practices to reduce cost. Initiate research on improvement of harvesting mechanism of combines to reduce harvesting losses. (CR, AE, FCS, FE, ENT)
19.1.3 <u>Cottonseed</u> . Production research on cotton (see pp. 44-45) considers factors that affect quality of cottonseed, oil and meal. (CR, AE, FCS, FE, ENT)	19.1.3 Intensify studies on breeding cottons with seeds that contain lower amounts of gossypol to contribute to widening feed use of cottonseed meal. (See also 18.1 and 18.2) (CR, AE, FCS, FE, ENT)
19.1.4 <u>Flaxseed</u> . Studies on adjustments in farming to meet changing market demands, price and cost relationships and income. (CR, FE)	19.1.4 Expand studies on development and vegetative propagation of hybrids less susceptible to cold injury; basic genetics, physiology and pathology; weed control to solve major production problems; needed adjustments in major flax areas to meet changing market demands. (CR, FE)
19.1.5 <u>Tung</u> . Development of equipment for efficient production and harvesting. (AE)	19.1.5 Applied phases of research on tung harvesting machinery should be curtailed. Tung breeding efforts should emphasize development of cold resistance. Study of the profitability of tung production in U.S. at world prices should be initiated. (AE, FE, CR)
19.1.6 <u>Other vegetable oil crops</u> . Research on development of castor bean harvesting machinery to solve major production problems; on chemical weed control in castor, sesame, and safflower; on development of safflower varieties of greater disease resistance; on development of better non-shattering sesame. (CR, AE, FE)	19.1.6 All current lines of research should be expanded to develop these and other new oil crops as profitable replacements for wheat, cotton, and other surplus crops. (CR, AE, FE)
19.2 UTILIZATION RESEARCH	
19.2.1 <u>Food</u> . Determining human requirements for and nutritional values of fats and oils; improving procedures in home and institutional preparation of foods in which fats and oils are used; determining current consumption of fats and oils and desirable adjustments for reasons of health. Developing new, more nutritious and attractive food products in which fats and oils and oilseed proteins are used. (HN, HHE, EU, NU, SU)	19.2.1 Specific areas needing expansion are: Determining the role of fat in human nutrition and its relation to other foods and nutrients to clarify health issues and agricultural implications; determining amounts and kinds of fat ingested in pounds in terms of caloric value, essential fatty acids, and existing food habits; determining minor constituents of fats and oils and their role in nutrition; obtaining and including fat and fatty acid content of all foods in food composition tables; determining potential contribution of oilseed proteins to food. Expand research to improve oilseed proteins and food fats and oils to make them more attractive to foreign consumers; to study the effect of processing and cooking of fats and oils on their nutritional value; to prevent undesirable changes in peanuts during processing and storage. Emphasis should be given the improvement of the chemical and physical properties of fat and oil products for food use as nutrition research points way to needed changes in composition. Work should be conducted in close cooperation between nutrition and utilization scientists on nutritional phases and with appropriate units of AMS on grades and standards implications. (HN, HHE, EU, NU, SU, AMS)

(See page 13 for key to agency symbols)

VEGETABLE FATS AND OILS (Continued)

PRESENT PROGRAM

RECOMMENDED CHANGES IN PROGRAM

19.2 UTILIZATION RESEARCH--Continued

19.2.2 Feed. Research on improving the efficiency of using fats and oilseed meals as animal feeds by improved processing of soybean and cottonseed to prevent loss of essential protein and eliminate antinutritional substances in the meal; on addition of fat to feeds; on stabilizing feed fat toward oxidation; on new oilseed crops as potential feed sources. Economic studies on oilseed meals and added fats in animal feeds.

(NU, SU, EU, WU, FE, AH)

19.2.3 Industrial products. Research to develop industrial outlets for fats and oils and oilseed meals, not needed for food or feed, through preparation of derivatives having diverse, high value, and preferably large volume use such as plasticizers, antioxidants, detergents, and industrial chemical raw materials. Study of fundamental fat and protein chemistry and methodology. Evaluation of new oilseed crops having special promise for industrial utilization. Economic studies on drying oil crops and other industrial oil crops.

(NU, SU, EU, WU, FE, FPR, FER)

19.2.2 Expand research to determine the fatty acids that are essential in animal nutrition; to determine the balance of fats and other feed components needed to give maximum feed efficiency and growth rate; to identify special nutrient factors and biologically active materials in soybean, cottonseed, linseed, castor, sesame, safflower and peanut meals; to study the relationship between oilseed meals and urea as nitrogen sources in feeds; to develop improved analytical techniques for essential amino acids. Initiate economic studies on the relative merits of using available and potentially new crops as feed meal. Initiate economic studies on the merits of attempting to detoxify tung and castor meals.

(NU, SU, EU, WU, FE, AH)

19.2.3 Curtail research on tung meal utilization for feed pending outcome of consumer studies (see also 19.1.5 and 19.2.2). Expand research on commercially pure fatty acids as industrial raw materials; on development of fat and protein chemistry and methodology; on the development of emulsion paints and other new industrial uses for linseed oil to counter downward trends in use as drying oil and make flax possible replacement crop for wheat; on industrial use of safflower oil because of high linoleic acid content and as possible replacement crop for wheat; on industrial use of castor oil to develop a domestic crop having practical as well as strategic importance; on industrial use of sesame oil because of high linolenic acid content to make sesame a possible replacement crop for cotton. Initiate economic studies on relative merits of available and potential new sources of fats and proteins as industrial raw materials, and of the likelihood of success in developing various industrial uses.

(NU, SU, EU, WU, FE, FPR, FER)

19.3 MARKETING RESEARCH

19.3.1 Efficiency in processing and marketing. Studies on reducing marketing costs and maximizing utility by analyzing market practices which affect prices and recommending improved practices; on determining and maintaining quality and efficiency through the various steps in handling, processing, and distributing oilseeds and fats and oils, including sampling, grading, packaging, and control of stored-product insects.

(MQ, TF, ME, MD, FCS)

19.3.2 Market information and outlook. Studies on appraising current and prospective economic position of fats, oils, and oilseeds, including related statistical and analytical work; on assembling, interpreting, and disseminating economic information pertinent to the world situation and foreign markets for oils and protein concentrates.

(AEC, FAS)

19.3.3 Domestic and foreign market development. Studies on consumer preferences and on appraising merchandising techniques to find and develop new markets, including expanded outlets for established and improved products as well as new products. Studies on foreign commodity and competition analyses and market development.

(MD, FAS, AEC)

19.3.1 Expand research on processing and marketing efficiency, particularly at secondary processing, manufacturing, and distributing level; on price problems in markets for oilseeds, fats and oils; on analysis of the basis for pricing soybeans, including protein as well as oil quality and quantity; on analyzing efficiency of plants and firms processing and marketing fats and oilseed products; on development of improvements in grading peanuts and cottonseed at farmer-buyer level; on development of data on practices and costs of processing and marketing flaxseed, peanuts, sesame, castor beans, and safflower.

(MQ, TF, ME, MD, FCS)

19.3.2 Expand outlook studies to provide regional analysis and to improve estimation of effects of world conditions on U.S. domestic markets. Improvement of supply-demand analysis requires additional statistical data on world basis and advance in methods of statistical analysis to handle problems of the high complexity involved. Accelerate and expand world commodity analyses to overcome time-lag in publication of information and to increase numbers of reports on major importing and exporting countries. Expand analyses of foreign competition through studies of production, consumption, and trade in major surplus-producing countries to appraise short- and long-term outlook for these countries. Expand studies of the world situation for particular commodities to determine the relative position of U.S. supplies in the world market and appraise the outlook for U.S. exports.

(AEC, FAS)

19.3.3 Expand studies on market possibilities and potentials as guides to technical research at very early stages of development of new and improved products, including trends in uses and consumption of fats and oils, with emphasis on uses for fatty acids as well as for natural oils, on products for industrial use, and on studies to determine effects of incipient developments in non-agricultural fields which impinge on agriculture. Expand foreign market development work with emphasis on the market for oil crops in Latin American countries and the Mediterranean area, on clarification of soybean grades for export, on possibilities for tailoring products to meet export preferences, on appraisal of increased use of synthetic detergents, especially in Western Europe, analysis and interpretation of information on foreign-produced oilseed cake and meal; and on impediments to U.S. trade. Curtail research on merchandising practices for food fats.

(MD, FAS, AEC, MQ)

(See page 13 for key to agency symbols)

LIVESTOCK AND FEED

The Department's livestock and feed research program is analyzed in this summary with indication of the nature and scope of the present program and the changes needed to balance and strengthen it. All of the recommended changes stated here will be fully implemented if the changes recommended under Objectives 1 through 16 are effected.

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM
20.1 FEED CROP AND ANIMAL IMPROVEMENT	
Genetics research and breeding studies to identify and improve germ plasm of plants and animals. Introduction and testing of new plants and new strains of known plants. Research on range grazing management to improve forage. (CR, AH, RMR)	Expand research on improving pasture and range grasses, legumes, and feed grains through breeding and introduction of new germ plasm; on the genetics of farm animals and the introduction of new germ plasm; on breeding techniques and methodology, including procedures for use in multiplication and distribution of superior germ plasm. Expand range grazing management research to improve forage. (CR, AH)
20.2 CULTURAL PRACTICES	
Research to establish feed crops and to improve nutritional value, palatability, and quantity of feed produced by better cultural methods. Research to improve equipment and facilities used in feed crop and animal production and to reduce labor and other costs in livestock handling, involving basic studies in plant and animal physiology, ecology, and cytology and in animal endocrinology. Research to improve forage through range management. (CR, AH, AE, RMR)	Expand basic research in animal and feed crop physiology, ecology, cytology, and biochemistry, including endocrinology and intermediary metabolism; research on equipment and facilities and livestock handling practices to reduce labor costs of livestock production. Expand research on management of forest and other ranges used by game, livestock, or both. (CR, AH, AE, RMR)
20.3 PROTECTION OF FEED CROPS AND ANIMALS AGAINST DISEASES, PESTS, AND OTHER HAZARDS	
Research to develop means for protecting animals and crops against diseases, insects, and parasites; to develop methods of controlling undesirable weeds and pests; to determine the toxicological effects on animals of chemicals used, or proposed for use, in overcoming these hazards. Research to determine the amount and nature of insecticide residue on feed crops and in animal products, involving studies in plant and animal pathology, immunology, parasitology, and endocrinology as well as basic studies on physiology and taxonomy of microorganisms, insects, and parasites. (ENT, CR, ADP, RMR)	Expand research on diseases and insects affecting plants and animals with particular attention to the effects of greater concentration, more intensive cultivation and irrigation on increasing the hazards of plant and animal production. Expand basic research on plant and animal pathology, including basic studies on the agents. Expand research on pesticides which will protect feed crops and livestock and which are safe and leave no residues in meat and milk. (ENT, CR, ADP, RMR)
20.4 FEED HARVESTING, PRESERVATION, AND COMPOSITION	
Research on methods and equipment for making and storing hay and silage and for drying hay and grain; on methods for analysis of feedstuffs; on evaluation of feeds by feeding. (AE, AH, MQ, CR, NU, WU, FE)	Expand research on harvesting feed with special emphasis on hay and on means of reducing labor required; on development of better equipment for getting feed from the field to the animal; on improving methods for analysis of feed with emphasis on forages and compilation of nutritive values of feed. (AE, AH, MQ, CR, NU, WU, FE)
20.5 ECONOMICS OF PRODUCTION	
Studies of the economics of livestock and feed production in specific farming and forest areas. Analyses of feed-livestock relationships. (FE, AEC, FER)	Expand research on analysis of production and demand prospects, feed-livestock relationships, and of economy of livestock and feed production in different farming, range, and forest areas. Initiate studies on production response to changes in cost-price relationships and other factors, and on the contribution of grassland-livestock farming to soil conservation and acreage adjustment. (FE, AEC, FER)
20.6 MARKETING PRIMARY PRODUCTS	
Research directed toward the first stage of marketing livestock and feed and includes study of facilities, work methods, marketing practices, and marketing organizations. (TF, ME, FCS)	Emphasize studies on improving the organization of primary markets and on increasing the efficiency of operations in those markets, developing improved techniques, and reducing the cost of facilities. Research in the South and Northeast particularly needs to be accelerated. (TF, ME, FCS)
20.7 GRADING AND STANDARDIZATION	
Research in developing objective techniques for grade classification of livestock, livestock products, and feed, with attention also to the relation of grade characteristics to breeding, management, nutritive value, edible yield, and household use. (MQ, HN, HHE)	Expand research to develop objective research-based standards for grading meat that will provide suitable bases for consumer selections. These studies should be coordinated with studies of the qualities consumers want in cooked meat with the characteristics by which they judge meat in buying. (See also 20.11), and with economic research on the impact of Federal grading. (MQ, MD, ME, HN, HHE)
20.8 TRANSPORTATION	
Research to improve transportation facilities, reduce losses in transit, and develop new techniques in transport of livestock, livestock products, and feed. Analysis of the effects of rates and regulations in interstate transportation upon the marketing of those products. (TF, MQ, ME, FCS)	Expand research on the relation between the method of handling animals, before slaughter and the quality of the carcass. Initiate research to develop temperature control equipment and devices for use in trucks and cars during warm weather and to measure their efficiency. (TF, MQ, FCS, ME)

LIVESTOCK AND FEED--Continued

PRESENT PROGRAM	RECOMMENDED CHANGES IN PROGRAM	
20.9 PROCESSING AND STORAGE	Research to increase efficiency of processing livestock and feed products and to improve quality; to develop new or improved products; to devise better systems for product storage and quality preservation. (MQ, TF, NU, SU, WU, EU)	Expand technological and economic research on methods of processing and storing meats and poultry including improved methods of curing pork; identifying flavor components in meat and poultry; developing continuous methods for preparing and suitable methods for storing whole milk powder. Initiate research to develop uses for byproducts of both livestock and feed crops. Expand research on market potential for new or improved products. (MQ, TF, NU, SU, WU, EU, MD)
20.10 WHOLESALING AND RETAILING	Research to improve facilities and practices and to investigate costs and efficiency in wholesaling and retailing of livestock and feed products. (TF, ME, MQ, FCS)	Increase research in wholesaling and retailing, especially of meats, with emphasis on irradiation and quick freezing. (TF, ME, MQ, AH, EU, WU, FCS)
20.11 CONSUMER NEEDS AND WANTS	Research to ascertain present and desired cooking qualities and palatability of various foods of animal origin, consumer preference for and actual consumer purchases of those foods in relation to household income and other factors, and the nutritional adequacy of consumption. Studies of the effect of educational programs and merchandising methods on consumption. (HN, HHE, MD)	Expand research to improve household practices in purchase and use of meats and poultry with breakdown by regions and season and on trends in patterns of meat consumption. Determine the underlying factors which motivate the use of specific meats, fats and oils. (HN, HHE, MD)
20.12 MARKET STATISTICS AND ANALYSIS	Research on production estimates, outlook, price determination and quotation, overall costs and margins, and supply and demand analysis. (AEC, ME, FE, AES, FAS)	Strengthen research with particular emphasis on the price determination process, and with special attention to the collection of production and market statistics and to appraisal of market potentials. (AEC, ME, FE, AES, FAS, MD)
20.13 EVALUATION OF FEDERAL ACTION PROGRAMS	Studies to appraise the consequences of acreage reduction programs on feed and livestock supplies. (FE, AEC)	Broaden present research, devoted chiefly to results of acreage reduction, to include studies of impact of other action programs. (FE, AEC)
20.14 COMPOSITION OF FOODS	Research on pork, lamb and poultry is under way with emphasis on proximate composition, minerals, certain vitamins, amino acids, and fatty acids. (HN, HHE, EU, WU, MQ)	Expand research to include more kinds of food such as processed forms of meat; include proximate composition, all amino acids, mineral elements, "B" vitamins, nutritionally significant fatty acids, and amount of separable fat and lean by cut and grade, raw and cooked. (HN, HHE, EU, WU, MQ)

(See page 13 for key to agency symbols)

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*A key to the symbols used to identify organizational affiliations of task group members appears on page 13.

